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Preconceived Physician Attitude Toward Computerized Physician Order Entry (CPOE): Implications for Successful Implementation

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PRECONCEIVED PHYSICIAN ATTITUDE TOWARD COMPUTERIZED PHYSICIAN ORDER ENTRY (CPOE): IMPLICATIONS FOR SUCCESSFUL IMPLEMENTATION

By

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CONTENTS

TABLES

FIGURES

ABSTRACT

There has been a societal and legislative push to implement computerized physician order entry (CPOE) systems throughout hospitals nationally in recent years due in large part to the public's awareness of an inordinate number of patient deaths due to medication errors in hospital settings. This mortality, and untold morbidity, became even more unacceptable when published findings suggested the majority of these 100,000 deaths each year could be avoided through the use of CPOE systems.

Yet acceptance has been slow and only a fraction of the hospitals have implemented this technology due to large start up costs, enormous technological requirements, and prior well-published failures of such attempts largely due to physicians' lack of acceptance.

A total of 71 participants were surveyed whose daily responsibility involved the ordering of medications, to determine what attitudes they had concerning CPOE systems. This was done at a facility scheduled to implement such a system over the next year. The data showed evidence supporting many of the current implementation strategies, while suggesting modification of others.

Based on these findings, recommendations are made for future implementations with the hope of gaining enhanced physician acceptance and adoption, facilitating a more successful implementation of CPOE systems.

Chapter 1

INTRODUCTION

In January of 2003, Cedars-Sinai Medical Center, Los Angeles announced it was suspending further implementation and use of a multimillion-dollar computerized physician order entry system (CPOE). The news reverberated throughout the healthcare information services community sending shock waves of caution to hundreds of other hospitals across the country which were concurrently being pressured into implementing CPOEs. The main reason for such a drastic action by the organization's senior management – lack of system acceptance by physicians!

1.1 Cedars-Sinai's Experience

Cedars-Sinai is one of the largest and most prestigious of the West Coast's medical centers. A tertiary academic center with over 877 beds supported by approximately 1,800 physicians [Morrissey04], Cedars-Sinai Medical Center enjoys the knowledge that it has the resources and experience to retain leadership in the healthcare industry. Always seeking to be the forerunning of advanced technology, the medical center began the planning and building of a CPOE heralded as a means to reduce healthcare costs and dramatically improve patient safety [Briggs04B] at any institution requiring the use of such technology.

After years of development costing millions of dollars [Benko03], Cedars-Sinai Medical Center finally suspended the use of a clinical application system designed to allow physicians to enter their orders using computers, as opposed to the older handwritten method traditionally used. Doug Jones, Cedars-Sinai's chief information officer stated [Benko03, page 12],

> "Our medical staff has made it clear over the past two weeks that we have some significant work to do in terms of physician-user acceptance."

The system, in operation less than four months, was literally unplugged after repeated complaints from physicians stating the system was too difficult and time-consuming to use and was posing a risk to patient safety [Benko03].

While the exact dollar amount of development, training, and implementation was never fully disclosed, Cedars-Sinai's experience with physician order systems underscores the importance of physician acceptance for successful implementation and has become one of the most cited [Morrissey04] warnings against proceeding without this support. Additional costs, including prolonged personnel time, inefficiency of processing patients, and lack of documentation for proper billing, further accentuate potential loss of revenue for the institution. Combine this with the initial start up costs of commercial enterprise system applications and one can appreciate the challenges facing hospital executives when implementing physician order entry systems. Over one year later, Cedars-Sinai Medical Center still has no plans for reimplementation of

the system and may be several years away further from revisiting the issue [Morrissey04].

1.2 Review of Study Objectives

When CPOE system implementation is examined closer, several main themes consistently are noted: the immense cost for development and implementation, the tremendous organization pressure to have working CPOE systems in place in the near future from multiple organizational fronts, and finally the frequent implementation failures. When these failures are further analyzed, it becomes most evident that lack of physician compliance, as evidenced by their non-acceptance and usage of these systems, is the single most relevant etiology of implementation failure. Given the dollars and significance of this new technology in the healthcare arena, it would be beneficial to gain a better understanding of what constitutes this "physician acceptance" and its significance with regards to successful implementation.

1.2.1 Generalized Conceptualization

Having witnessed and enjoyed the privilege of enduring several major healthcare application implementations over twenty years while working very closely with physicians in a clinical setting, it became apparent that most physicians seemed to form opinions of the success or failure of computer systems long before such systems were ever implemented. Information was primarily disseminated from peer to peer

with heavy reliance on those physicians who were deemed to be "computer literate" and subsequently felt to be the most appropriate people to evaluate the system's appropriateness or inappropriateness.

One could inevitably predict the success or failure of physicians' compliance well in advance of the actual implementation based on the information being passed from physician to physician. Presumably, if the assumption that physician opinion is heavily biased by these pre-implementation discussions, then a simple hypothesis could be suggested that physicians' pre-conceived attitudes toward CPOE would weigh heavily on the success or failure of such a system.

Yet, when examining the literature, there remains a paucity of research to specifically address the attitude and mind-set of physicians prior to implementation of CPOE systems. A considerable amount of work has been published [e.g., Sellers94, Poon04], concerning physicians' attitudes during various phases of implementation, yet most remain retrospective in approach.

A primary goal of this study was to capture the thoughts of physicians before implementation had actually started in an attempt to capture any pre-conceived notions that might have already developed. The intent was to draw conclusions as to the success or failure of implementation approaches based on our findings. Presumably, if one understood the mindset of the intended physician audience, specific recommendations could then be made for training and educating the physician group,

thus significantly increasing the probability of a successful implementation. Additional benefits of such information could provide validation or invalidation of established techniques considered standard practice for CPOE implementation throughout the country.

1.2.2 Process Overview

The study first proceeded with an extensive literature research to examine current published data regarding CPOE implementation with specific regards to physician attitude and compliance. Verification of a lack of prior studies in this area was confirmed and the design of a physician questionnaire to capture subjective opinions and comments was begun.

A target group of key healthcare providers whose job function includes writing orders for patient therapy, medications and interventions was identified. While primarily physicians, this group also included physician assistants, advance practice nurses, and pharmacists; this paper will collectively refer to this target group as physicians for the sake of simplicity, separating individual professions when indicated for clarity and discussion. The questionnaire was then distributed in a survey fashion to this target group at an institution that had just begun the early process of making recommendations for the eventual implementation of a CPOE system.

The surveys were then collected, recorded and the data analyzed. From this analysis, it was hoped that specific recommendations, as well as validations of current techniques, could be determined.

1.2.3 Potential Application

The potential significance of these findings could have dramatic impact on how organizations proceed with implementation strategies. Potential savings from success or failure of CPOE implementation would obviously be the foremost goal, however the potential for several secondary benefits might be gained. Insight into social and administrative dynamics, while not the intent of this study, could certainly provide paths for improved communication and organizational processes through an enhanced understanding of issues and concerns physicians face when forced to use new technologies. The resultant goal could ultimately improve the efficiency of installation of other systems, thereby further improving the safety and care of patients while continuing to reduce healthcare costs.

Another potential goal would be the understanding how physician users form perceptions of CPOE systems and the significance of this process for designers of future CPOE systems. This has been applied generically to users of innovating software by studying a variety of factors including stages of adoption, implementation processes, organizational factors, subjective norms, and user competence [Chiasson01] in the context of Roger's perceived characteristics of innovation [Rogers95]. If this

process remains applicable in our audience and domain, certainly potential improvements in future designs would not be unreasonable nor unforeseeable. Finally, the potential validation of current practices associated with the implementation of CPOE in addition to suggestions for redirection based on our findings, if applicable, would also prove beneficial.

Chapter 2

COMPUTERIZED PHYSICIAN ORDER ENTRY DEFINED

Before proceeding further, an understanding of terminology and basic concepts is essential for further discussions. Unfortunately, like most industries, computerized application terminology in healthcare often is applied in numerous settings with resultant variations of meaning depending on context of use. A brief description of terminology as it applies to our study is presented for clarity and understanding.

2.1 Definitions

Computerized physician order entry (CPOE) system refers to the use of computer technology for entering patient orders directly into a healthcare organization's computer system. Traditionally, patients are admitted, cared for, and discharged based on directions given to the healthcare team, usually by a physician, in the form of individual written orders on a specified paper contained in a patient chart. The patient chart is kept at a general location on each floor and also contains such documentation as lab results, provider notes (clergy, social services, physical therapists, consultants, and others for example) that have been involved in the patient's care.

When all of this information is collectively created, stored, and referenced in a computerized system, it is called an electronic medical record (EMR). The EMR has long been seen as the magic silver bullet to improved patient care and reduce healthcare costs through efficiency, speed and exchange of standardized documentation [Briggs04B].

CPOE is a part of the EMR, but not a replacement for the EMR. One must have CPOE to have a true EMR, but one could always have CPOE without an EMR. Indeed, CPOE is often seen as one of the pieces that must be in place to move forward with an EMR.

Additionally it is important to understand that both CPOE and EMR can, and often are, implemented on a limited basis and then gradually incremented through a spectrum of phases. For instance, CPOE at its most rudimentary level would consist of a process that allows physicians to simply input an order using a computer. This order would subsequently be printed and placed in the physical patient chart and handled in a traditional manner. The immediate unused potential of the computer system using this approach is evident, yet by formal definition it could be classified as a CPOE system and eliminate the most common cause of patient care errors – inability to correctly read or transcribe a handwritten order from a physician [IOM99].

However, real CPOE systems involve much more than simple physician input. They include the ability to provide real-time physician alerts for possible drug interactions,

incorrect dosing, and alternative medications. They also can provide templates and suggestions to adhere to best-practices standards of clinical care. It is here that the benefits of improved patient care and cost reduction is realized.

Additionally, the actual process of input may involve the use of personal digital assistants (PDA), wireless tablet or mini-PC platforms, Internet and intranet interaction, or even possible voice-activated entry. Each of these approaches may have differing effects on physician practice and compliance.

2.2 Origins and Motivations

While the concept of improving patient care through the use of computerized applications has always been a long-term goal of many institutions seeking to improve efficiency and patient care [Hammond87], the complexity and magnitude of the healthcare industry has always overwhelmed those willing to attempt these goals. As early as the 1960s, it was generally felt a successful system was only, "a simple matter of programming" [Hammond87, page 153], a statement that quickly evaporated once engineers began to analyze the complexity of patient care and the unyielding, stoic technology of mainframes and early medical monitoring devices.

Over the years, few attempts were made at harnessing the vast amount of information involved in patient care settings, helped along by the introduction of the personal computer and decreasing costs of technology, which allowed functions to be

performed by smaller and cheaper minicomputers. It was during this time engineers begin to seek physician input into design functionality. One project done at Duke University in the late 1960s sought physician input into the design of an automated patient history module for use by physicians in the Department of Obstetrics at Duke University. Initial attempts produced a 23-page narrative print containing nearly all possible parameters and questions – a document that proved too overwhelming for a busy obstetric practice and ultimately more work for those physicians taking the patient histories [Hammond87].

Ultimately, a return to the original contributing physicians produced a simple ten-line document with the concise patient information needed for management of these patients. The engineers learned an important difference between required and desired functionality. They also learned physicians were not engineers and engineers were not physicians, a necessary relation that must be balanced with care to produce workable and productive systems in the healthcare industry.

System development continued over the years as technology and the development process matured, but it was not until 1999 that the push to implement such systems became paramount. In 1999, the Institute of Medicine released a landmark report entitled, "To Err is Human: Building a Safer Health System," which initiated a public awareness and outcry that reinvigorated the push to implement such technology in the patient care settings [IOM99].

In their report, the Institute of Medicine outlined the top ten causes of death over the prior year (1998), which included entities such as heart disease (number 1), cancer (number 2), and motor vehicle deaths (number 8). But what the public was not ready to learn was the number five leading cause of death was listed as "Medical Errors" [IOM99]. The same report estimated that as many as 98,000 hospital deaths each year were directly attributable to medical errors.

This report, conducted by a blue-ribbon panel of industry experts was released in November of 1999 and gained widespread media coverage resulting in public outcry. Further analysis of these "medical errors" proved a majority of these were due to medication errors [IOM99]. The previous model of comparing standards of practice against other institutions was questioned and forced policy makers to rethink their priorities. Julie Morath, the Chief Operating Officer of Minneapolis Children's Hospital and Clinics was quoted as stating [CAB01, page 6],

> "We used to compare ourselves with the industry, and we compared well. Then all of a sudden it struck us that maybe the whole industry is not good enough."

The media attention and increased public awareness demanded these issues be addressed and forced institutions to consider large-scale reform. Most disturbing, however was that the majority of these 98,000 hospital deaths caused as a result of medication errors could be potentially prevented by the use of CPOEs. CPOE was found to reduce the incident of serious medication errors by as much as 55% [Poon04]

and as far as 78% reduction in higher acuity settings such as intensive care units [CAB01].

This collective evidence prompted the LeapFrog Group, a national consortium of Fortune 500 companies which sets standards for voluntary adherence by institutions, to designate CPOE deployment by hospitals as one of the three main patient-safety goals [Poon04]. By leveraging its membership of large corporations that purchase health care benefits, LeapFrog has significant power to influence how hospitals provide care through adherence to their safety recommendations [CAB01].

2.3 Historical Applications

With the focus now on patient safety and elimination of medical errors for in-patient settings, one might assume widespread adoption of methods to help achieve these objectives, yet implementations of technologies to prevent these errors have been met with limited success. When reviewing a history of previous attempts to help eliminate errors through the use of technology, it becomes readily apparent that a changing healthcare delivery system requires and demands a changing paradigm in the underlying system architecture [Lincoln94].

Initial attempts were focused on all-encompassing systems where patients were admitted to hospital wards and kept for extended periods of time. Care was provided by primarily one or two physicians who knew the patient's background and had near

complete autonomy with respect to treatment approaches and clinical interventions. Here, patient information was fairly well localized and little, if any, ancillary use of this information was required by other departments.

This is contrasted today with multiple different physicians caring for a single patient, perhaps at the same time, and the needs for patient access across delivery modules in other areas of the hospital to include pharmacy, laboratory, radiology, billing and other departments requiring dissemination of patient information. The complexity of rules now governing how physicians provide care, such as insurance, state and federal regulatory, as well as institutional practices, further complicates attempts to streamline care. Implementation of such a system equates in scale with what President Dwight Eisenhower did in the 1950s by creating the national highway system [Briggs04B].

Early attempts at CPOE implementation proved less than ideal, as the opening example (Cedars-Sinai Medical Center) illustrated, and could be financially and publicly embarrassing. Central to these early attempts were problems with a lack of robust applications, poor access to workstations, and physician indifference, which slowed adoption and commitment by hospitals [Barcia00]. Combined with the projected implementation costs starting at five million dollars [Scallse02A], hospital administrators began asking for validation of such systems and wondered if CPOE would actually perform has predicted [Barcia00]. Skeptical of a positive value-cost ratio, John R. Holcomb, M.D., vice president of clinical services at Methodist Healthcare, a six-hospital system located in San Antonio, Texas states, "The vast

majority of medication errors are relatively inconsequential" [Scalise02A, page 50]. Additional concerns about a lack of a computerized foundation further slowed implementation schemes. A successful CPOE system must be built on a comprehensive electronic clinical data repository that most hospitals lack [CAB01].

Despite these concerns, as later studies will show, the overwhelming evidence does exist for the effectiveness of CPOE to reduce medication errors and thus improve patient safety. Because of this, many hospitals are still determined to overcome the large financial startup costs and move forward with CPOE implementation.

Lessons learned from these early attempts are both promising and cautionary. Among one of the first hospitals in the nation to begin using CPOE systems, Alamance Regional Medical Center has been using CPOE for patient orders successfully since 1998 [Shelton03]. The hospital was built in 1995 with the expectation of CPOE implementation, which eliminated many of the physical constraints associated with retrofitting older facilities for new technology. Despite their success, however, it is still noted that only approximately 70% of their physician staff actively use the system due the reluctance of a particular group of physicians to perform perceived clerical work [Shelton03].

In October of 1995, the Veterans Administration introduced a CPOE module as part of the healthcare information system. A study examining the use of this module by resident physicians revealed nearly 95 to 100% of all resident orders being entered

through CPOE [Cutolo98]. They attribute their success in part to a constant modification of the computer interface in response to continuous physician feedback.

This same approach was taken by Loma Linda University Medical Center in Loma Linda, California. Physicians at the facility have been actively involved and enthusiastically directly participated in CPOE implementation slated to go live in April 2004 [Rogoski04]. By listening to physicians' concerns and feedback, Loma Linda University Medical Center officials were able to keep customizing and simplifying the application to improve the physicians' workflow. Other reports of successful implementation of commercial CPOE systems can be found, including Cottage Health System, a three-hospital based healthcare delivery system located in Santa Barbara, California [Schuerenberg03]. At Cottage Health System, the goal was to provide physicians with as much information as possible in a usable manner to allow them to make better decisions about patient care management.

Despite the Cedars-Sinai failure to implement an in-house custom developed CPOE application, not all hospitals have chosen the commercial route. Financial concerns eliminate a commercial enterprise system as a viable option for most of the smaller community hospitals, yet some have found innovated ways to implement custom versions of CPOE. Oakwood Center of Palm Beaches, saddled with shallow pockets and deep resolve, embarked on a custom project which resulted in an electronic medical record system that eventually included a CPOE component. With five locations and only 44 beds, nine physicians, and 35 nurses, the system is no

competition for larger university hospitals, yet through cohesive communications with the physician's staff, a successful system was developed and implemented [Briggs04A], suggesting a smaller target audience as a benefiting factor for custom built systems. Although limited in functionality, core elements have been successfully implemented, proving a large cooperate budget is not necessarily a prerequisite to beginning a CPOE project.

Larger settings have not been as successful with custom-built CPOE applications. In addition to the Cedars-Sinai illustration, Intermountain Health Care's LDS Hospital located in Salt Lake City, Utah, and Vanderbilt University Medical Center located in Nashville, Tennessee, have also chosen to custom build their own systems instead of relying on commercially available products [Benko03]. Yet Vanderbilt halted the launch of an earlier CPOE system in 1994 after physicians complained it was "too clunky" [Benko03], and Intermountain's attempt has not been fully realized, requiring a gradual and incremental planned installation.

Chapter 3

RELEVANCE AND SIGNIFICANCE

So what is the research behind CPOE and why should hospital executives develop plans to implement such technology given the expense and past failures of reputable institutions? Why has the industry focused on CPOE as a solution to the safety concerns? With a little clearer understanding of the process applied in most hospitals, it becomes readily apparent CPOE can, and does, improve patient safety through the elimination of common medication errors.

3.1 Why Important

At first glance, the process of prescribing a medication, regardless if performed within the confines of a hospital or in an out-patient setting, might seem relatively straight forward. Simplistically, a physician makes a determination, writes an order or prescription that is then "filled" and given to the patient. Yet when scrutinized, the process actually involves numerous groups of processes that include the thought process and selection of the medication, the actual transcribing or writing of the medication, the review of the order, the transmittal to the pharmacy, the review by a pharmacist, the dispensing of the medication, the return to the floor or patient, and finally, for hospitals, the actual administration of the medication.

This whole process can then be further sub-divided into multiple detailed steps. For instance, the process of writing the drug includes the documentation of the correct drug, correct dosage in the correct units, time interval, and route, in addition to any special administration instructions or concerns. This must be done in a standardized format taught in every medical school and most importantly, legible for review by the nurse, pharmacist, and others involved.

The above process specifically highlights one of the areas of most concern, since studies have proven that a vast majority of the medical errors are directly related to the legibility of the physician's written order [Lesar02]. Contributing to this is a lack of resources immediately available, leaving the physician with a possible inadequate drug therapy knowledge of an individual patient or condition, compounded by an ever-increasing complexity of drug interaction and a market flooded with newer agents produced each day. Dosage calculations, adjustments for compromised metabolism and biotransformation all affect which drug is selected and at which dosage and route it is administered. Even when physicians use a standardized form for ordering drug therapy, an excess of 50% in errors can still be expected [Lesar02].

Another level of complexity is added when physicians use common abbreviations and acronyms unknown, or worse, recognized as meaning something different than originally intended by those outside the area of specialization from which the

physician was prescribing. The use of communal expressions and terms is often done at the expense of clarity [Bloom00].

Yet many, if not all of these concerns, can be eliminated through the use of CPOE. Certainly the legibility factor is immediately removed, a fundamental determinant of medication errors [Buurma02]. The Agency for Healthcare Research and Quality estimates that up to 95% of all adverse drug events could be prevented by reducing errors through CPOEs citing the ability of these systems to counteract physicians' notoriously illegible handwriting [Edlin02].

Systems that leverage patient specific data can provide recommendations for modifications based on the patient's height, weight, sex, age and co-morbidity of other medical conditions. Alerting the physician to known drug interactions is often a common feature of CPOE systems [Klasco03]. Additional references that can provide standard of care practices and cost benefit ratios are readily available to physicians at the time of prescribing, further enhancing their decision-making process.

Implementation of CPOE at Harvard's Brigham and Women's Hospital reduced errors by 55%, with rates of serious medication errors dropping by 88% [Klasco03]. The same reference cites LDS Hospital in Salt Lake City, Utah, reducing antibiotic-related adverse drug events by 70% and furthers states if CPOE were adopted at all non-rural hospitals, over half a million medication errors could be prevented each year! Additional studies suggest as many as 3-5% of all hospital admissions are related to

medication errors with 5-8% of all hospitalized patients experiencing a serious adverse drug reaction prolonging hospital stays and increasing healthcare costs [Fattinger00].

Boston Medical Center's decision to implement CPOE technology showed a consistent general medication error reduction rate of more than 50%, with a specific reduction in the prescribing error of 37% since implementation [Schuerenberg02]. If the LeapFrog Group's three patient-safety practices, which includes CPOE, are implemented in America's urban hospitals, nearly 60,000 lives could be saved and more than 500,000 medication errors prevented annually [HCL02]. Another source [McConnell01] states that LeapFrog Group's policy alone could affect more than twenty million people!

3.2 Motivational Factors

One might conclude that the whole issue of CPOE is really not significant to the average person, aside from perhaps a decreased probability of having a medical error occur should one be unfortunate enough to require hospitalization, relegating its discussion and responsibility to those involved in providing medical services and computerization attempts. However, a closer examination reveals several motivating factors from the institutional, individual, and societal perspectives. With preventable medical errors resulting in more deaths annually than vehicle accidents, breast cancer, or AIDS [Chordas02], motivation for supporting the technology to prevent these deaths can originate from several points of view.

3.2.1 Institutional Motivation

Since CPOE technology is implemented at hospitals, these institutions must have a reasonable desire to incur the expenditures and risks of instituting such systems. A major force behind this drive has been the LeapForg Group. This powerful interest group was founded by Fortune 500 CEOs and describes itself as a voluntary program aimed at mobilizing large purchasers to alert the healthcare industry of the importance of providing patient safety. This is accomplished through recommendations for services based on independent reviews of implemented technologies, such as CPOE, with preferential nods of approval and subsequent recommendation to those companies purchasing the healthcare services [Klasco03].

Another major component driving institutional desire to implement CPOE comes from the Department of Health and Human Services. To remain eligible to receive federal funding (Medicare and Medicaid dollars) each institution must meet criteria outlined by the Department of Health and Human Services. These funds consist of a large percentage of hospital reimbursement and cannot be ignored if one wishes to remain viable in today's healthcare environment. Effective in March 2003, The Centers for Medicare and Medicaid Services outlined steps that require a quality assessment and performance improvement program concerning medical errors which strongly favors the use of CPOE systems, hinting an eventual requirement [HCP03].

Finally, despite the initial large startup costs, CPOE systems have been proven to substantially decrease overuse, under use, and misuse of healthcare services and hospital resources, producing measurable decreases in hospitalization costs. This reduction in costs is realized through decreased length of stays, decreased medical errors, and improved physician compliance with standard of care practices [Kuperman03].

Additional legislation has been enacted at the state level forcing hospitals to take CPOE technology more seriously, including recent California Senate Bill 1875, enacted September 28, 2000, which required hospitals to submit medication error reduction plans to the state by January 1, 2001. These medication error reduction plans must include error-reducing technologies, such as CPOE, to be fully implemented by January 1, 2005 [CAB01].

3.2.2 Individual Motivation

Despite the reluctance of physicians to accept CPOE systems, there are many motivators to persuade practicing physicians to embrace such technology. Perhaps the largest motivator is the decreased liability that comes from using standardized practice techniques. This is a generally well known concept that is used as the basis for malpractice claims against physicians today. It is reasonable to assume if the use of CPOE systems forced physicians to use standard of care practices by controlling available prescribing options, their potential liability, at least from the defense of

noncompliance with standards of care with relation to prescribing activities, would be drastically decreased.

Additionally, the inherent benefit of using computerized systems to improve efficiency and expand the available patient information that is readily available to the physician is also a motivator. Ironically, these are some of the exact complaints listed by physicians who chose not to use CPOE for fear of loosing autonomy by being required to follow a set of practice rules, and a lack of productivity by being required to use a computer system to do something that they feel could be handwritten in less time. Yet when these physicians are actually immersed in using the CPOE model (either through coercion or institutional requirements), they become some of the most ardent supporters of this technology [Scalise02A].

3.2.3 Societal Motivation

Although the goal of reducing hospital deaths from medication errors through the use of CPOE is certainly desirable from both an institutional and physician perspective, there is a larger societal benefit that should be considered. With healthcare cost escalating each year, the move to manage costs through technology is hampered by the inability to share information across varying systems, impeding efficiency of patient care [Grimson00]. The ability to seamlessly share patient information would streamline the patient care experience between disciplines and reduce the overhead associated with billing and third party reimbursement systems. In a lengthy

commentary on this subject, Jane Grimson also suggests it would further the advance of best-practice and evidence-based medicine by allowing the collective accumulation of patient care outcomes to be easily studied [Grimson00]. Privacy issues aside, CPOE would help facilitate this goal through a computerized record of therapy options across a spectrum of diseases.

3.3 Long-term Perspectives

Richard Klasco, in his paper entitled "CPOE: Why Don't We Get It?" [Klasco03, page 52] is quoted as stating:

> "The image of the illegible, handwritten prescription must be banished to the museum of medical antiquities, so we can all shake our heads in amused disbelief that there was ever a time when medicine was so crude."

This sentiment is echoed by the LeapFrog Group who feels "CPOE is the gold standard for reducing serious medical errors" [Shelton03]. Hospitals struggling to meet ever rising costs are now realizing that medical mistakes and economic realities are mandating the widespread use of CPOE systems to make healthcare safer, cheaper, and smarter. Several major institutions, including Brigham and Women's Hospital in Boston, Massachusetts, and the Royal Victoria Hospital in Montreal, Canada predict CPOE will become part of standard medical practice in the next ten years [McConnell01].

More recent studies have established quantitatively that CPOE systems are cost-efficient, not just for physicians, but for other disciplines as well. A study done at Montefiore Medical Center in New York showed an average of $1,527,252 per year in 2002 in ward clerk savings (those people who traditionally transcribe physician orders from the written chart to another form for nursing review and eventual system entry), $715,400 per year in nursing dollars, and a huge $2,044,000 in pharmacist dollars by implementing CPOE at their institution [Taylor02]. These savings were calculated in part by comparing the time each discipline traditionally spent performing their duties with relation to physician orders with time spent after the CPOE system was implemented. Not surprisingly, the largest savings, represented by the pharmacists, was due to nearly 60% reduction in the time they spent handling and processing traditional paper medication orders.

With potential savings such as listed above, combined with an ever increasing body of evidence citing the proven affects of CPOE on reducing medication errors and improving patient safety [Cook02], it is not surprising to see legislation aimed at providing incentives for early adoption of this technology and mandates for eventual implementation [Doolan02, Meadows02]. According to the Gartner Group, many states will pass legislation over the next several years that will require hospitals to develop and implement a plan for reducing medical errors through automated order entry systems and other means [Chi01].

Chapter 4

PHYSICIAN ACCEPTANCE

How does physician acceptance fit into the CPOE implementation equation? If CPOE truly has the potential of significantly decreasing costs, improving efficiency, and improving patient care, why would any physician chose not to adopt this technology? Why is this acceptance paramount to a successful implementation? This is discussed in more detail in the next two sections.

4.1 Significance for Successful Implementation

The number one reason most cited for implementation failure is physician resistance [Briggs04B]. As early as 1960, it became readily apparent that success or failure of any innovation in the medical setting was heavily dependant upon the attitude of the physicians involved [Hammond87].

This is well documented by many institutions and unfortunately the landscape of CPOE is littered with stories of spectacular system failures as the result of day-to-day struggles between physicians and healthcare executives [Hamilton03]. A survey of 53 hospital executives by Harvard Medical School researchers identified the top barrier to

implementing CPOE systems as physician resistance, leading the cause of failure [Poon04].

Without physician adoption, the potential for CPOE technology will ultimately remain unrealized [Scalise03A]. As the primary users of CPOE, hospitals must learn how to overcome resistance from physicians when implementing CPOE systems.

4.2 Etiologies of Physician Reluctance

The initial reaction from physicians was their impression that using a computer to enter orders is a much slower process than handwriting an order [Briggs04A]. Donald Levick, M.D., physician liaison at Lehigh Valley Hospital in Allentown, Pennsylvania, points out that the number one concern expressed by physicians was that using a CPOE system would ultimately cost them money by decreasing the time available to see patients outside of the hospital [Anderson03]. While this might be true on the surface, CPOE technology can significantly reduce the time from order to result [Briggs04A].

A closer examination of physicians' reluctance involves much more that the just the perceived time issue. Numerous other factors provide psychological, behavioral, and technological barriers to adoptions of such technologies. An intriguing look at the potential of nurses facilitating physician acceptance draws attention to several real barriers not often commented on in traditional, peer reviewed physician journals.

These include suggestions that the need to prove superior intellect by virtue of training limit physicians' desire to place themselves in situations or environments were they feel helpless or unskilled [Simpson00].

Lending et al. demonstrated the strong influence of "self-efficacy" on an individual's adoption of an information system, supporting the assumption that most users only provide acceptance after a certain level of user proficiency has been reached or obtained through similar applications – something that is difficult to do in new application fields such as CPOE [Lending04].

Another factor contributing to physicians' reluctance to use CPOE systems is the perception that such systems interfere with their work-flow. James G. Anderson, citing experience over the past three decades, showed that when implementation of information systems interfere with traditional practice routines, they are not likely to be accepted by physicians [Anderson97]. Earlier work demonstrated that barriers to the use of information technology within health care delivery systems were driven by several factors that include sociological, cultural, and organizational – not just technological [Moore96].

Extending further into the psychological etiology of physician reluctance is that physicians have traditionally enjoyed considerable authority and autonomy to treat patients as they felt necessary. The addition of excessive insurance and state and federal regulatory requirements is seen by most physicians as an intrusion into the

physician-patient relationship and generally felt to diminish human concern and interaction in exchange for automated, government controlled care [Anderson90].

Chapter 5

CURRENT IMPLEMENTATION STRATEGIES

Armed with the knowledge that physician acceptance is crucial to successful CPOE implementation, administrators and health care executives have attempted several techniques to gain physician support over the years. The most obvious of these is to seek advice and obtain physician involvement as soon as a decision has been made to move forward with a CPOE implementation plan [CAB01].

Several studies outline implementation strategies that helped physician acceptance. Eric Poon, et al. concluded four simple strategies: a strong executive leadership, identification of physician champions, addressing workflow concerns, and leveraging house staff and hospitalists for initial implementation [Poon04]. Howard J. Anderson lists these strategies a little differently in his research as the emphasis to physicians that CPOE will improve patient care, ensure the medical staff that they are in control, creation of a strong technical support staff, and CEO support as well as board of directors' support [Anderson03].

A common theme of administrative support is discussed to imply physicians' reluctance to change behavior if they feel the project will ultimately be abandoned.

Hospital leaders must be firm in the benefits of this technology and convey this belief to the physician staff [Poon04].

Allowing physicians to participate in part of the design and implementation process provides a sense of ownership in the project and helps dissolve an administrative-physician barrier. The use of physician champions, named for their role in championing the CPOE cause to physician colleagues with influential demonstrations and early adoption has also been well established as a technique to help diffuse reluctance [Briggs04B].

Understanding physicians' workflow is essential to removing one of their major concerns. Emily Wolf documented the drastic way many CPOE systems alter physicians' work [Wolf03]. Hospitals should thoroughly understand the workflow processes before implementing a CPOE system and should run pilot trials on a limited scale to insure workflow patterns are not disrupted whenever possible [CAB03].

In addition to the need to adopt an "anytime, anywhere, anyway" approach to supporting and training physicians, other institutions have found unique approaches to eliminating physician concerns. It is possible to engage physicians through the use of alternative approaches such as the use of PDAs [Scalise03B]. Hospitals as well as health care organizations have found by giving physicians free PDAs, the physicians are more likely to use their CPOE technology without the traditional struggles many institutions have mandating adoption of CPOE systems [Schuerenberg04].

Chapter 6

PHYSICIAN SURVEY

With a discussion of the relevance, importance, and need for physician acceptance of CPOE system implementations concluded, the original focus of this paper can be explored: to determine physicians' pre-conceived attitude toward CPOE systems and the potential impact this has on successful CPOE implementation. The next sections will elaborate and discuss the methodology, distribution, and compilation of the survey results.

6.1 Purpose and Goals

As stated previously, the primary purpose was to capture physicians' thoughts and opinions prior to a CPOE implementation at a given institution. Baptist Health System, a major provider of healthcare service to northeast Florida and southeast Georgia, presented a unique opportunity to explore these questions closer. Specifically, the opening of a new hospital on the Southside of Jacksonville, Florida, scheduled for February of 2005, was slated to be entirely paperless, employing a CPOE system as well as other technologies.

The healthcare system made a decision to mandate adoption of CPOE as a requirement of privileges at the new facility. This provided an opportunity to survey potential physician staff to ascertain their thoughts and opinions with regards to CPOE prior to a full scale implementation of physician training and education.

6.2 Methodology

Permission was sought and obtained from the chief medical officers of Baptist Medical Center Downtown and Wolfson Children's Hospital for the distribution of a survey to the medical staff at various functions. Additionally, administrative support was granted for participation and attendance at many of the CPOE educational meetings held by the Director of Medical Informatics for Baptist Health System. This access proved critical to the distribution and submission of the surveys to physician staff. The surveys were meant to be anonymous with respect to individual physicians, yet required a personal delivery and follow up methodology to obtain an adequate pool of responses.

6.2.1 Survey

The actual design of the survey consisted of three main parts: limited physician demographics, expression of current understanding of CPOE, and a final section consisting of physician preferences for implementation. A copy of the survey can be found in Appendix A: Original Survey.

A disclaimer was required by Baptist Medical Center prior to distribution to clearly delineate a collegiate study versus a hospital implementation policy. The survey was distributed to both chief medial officers and the director of medical informatics for input and revisions prior to the actual distribution process.

A distinction was made between different providers to include pharmacists, physician assistants, advanced nurse practitioners, and physicians. The physicians were further subcategorized as Residents (those physicians who have completed the training for a Doctor of Medicine degree, but lack the residency requirement to practice independently their own), Fellows (physicians who have completed residency requirements and are allowed to practice independently, but have chose to extend their education for one or more years of additional specialized training in a particular field of specialization), and Attendings (those physicians who have completed all educational requirements and are practicing professionally on an independent basis).

The term "hospitalist" was meant to signify the physicians' practice being solely based with in a hospital setting (such as an intensive care physician). Specialty and a more general division of adult versus pediatric care were also requested. Finally demographic information included an average number of patients seen by the physician during any given week and whether those patients were primarily in an intensive care unit, a regular hospital room, or a combination of both.

Opinions, general thoughts, and understanding were assessed through the use of a sliding scale from which the physician would chose to "agree strongly" with a given statement, "agree moderately," remain "neutral," or "disagree moderately," or "disagree strongly." An additional response was allowed for those statements the physician felt were not applicable or did not apply, "N/A."

The third and final section of the survey allowed the participants to rank according to preference their most desired selection regarding CPOE usage, training, and support. Sequential numbering from the most desired (indicated by 1) to the least desired (indicated by a number as high as the number 5) was employed.

Additional information was included to allow for the return of completed surveys to the appropriate department and contact person. Each survey was hand-numbered for purposes of tracking distribution.

6.2.2 Distribution

The surveys were distributed during a period of approximately four weeks beginning September 7, 2004 and ending October 6, 2004. Surveys were distributed throughout the hospital including hospital pharmacies, physician dinning rooms, various call rooms, and at informatics training booths. Additionally, they were distributed at various professional meetings including general lectures (Pediatric Grand Rounds) and medical informatics information and training sessions.

Personal attendance at the above functions proved to be most successful in returning completed surveys, with a personal request to complete the form aiding tremendously in compliance.

6.2.3 Compilation

Once completed and returned, each survey was placed in an envelope until completion of the predetermined allotted distribution time period. At the end of this time, the surveys were removed and examined for appropriate completeness. Those forms deemed successfully completed were assigned a reference number, then manually tabulated using Microsoft's Excel for Windows 95 spreadsheet on a standard Dell Pentium III 1.4 MHz computer with 20 gigabytes of hard drive storage running Microsoft® Windows 95 OS. Individual responses and any other comments or physician responses were recorded for each survey. These results can be found in Appendix B: Raw Data.

Adjustments were then made for purposes of consistency and further analysis where variations of interpretation might have otherwise produced unintended results, and where the adjustments were not felt to represent an interpretation of the participants' original intentions. The first of these adjustments involved the selection of the "hospitalist" demographic question. While this term is subject to considerable interpretation, for purposes of our study it was intended to signify that the physician's

sole patient care activities were done in a hospital setting. If other documentation was provided, such as listing a position that can only be practiced in a hospital setting to include intensive care positions or emergency room physicians, this question was changed to reflect the original intent of the survey.

Another clarification was made with regards to the delineation of advance practice nurses and physician assistants. The original questions list both of these options under the same choice, but due to the distribution method, it was known by the surveyor if the participant was either a physician assistant or advanced nurse practitioner. Additionally, those who selected this option and listed the pediatric intensive care unit as the sole site of practice could be determined to all be physician assistants due to the composition of the work force in the pediatric intensive care unit.

Additional changes were made for consistency of practice specialty. For instance, "neo," "neonatology," "NICU" all refer to the specialty of Neonatology and were changed accordingly for ease of interpretation. This specialty also exclusively works with neonates, of type of pediatric patient so if the "adult" and "peds" boxes were left unchecked, the "peds" box was checked for completeness. The same process was used for other specialties.

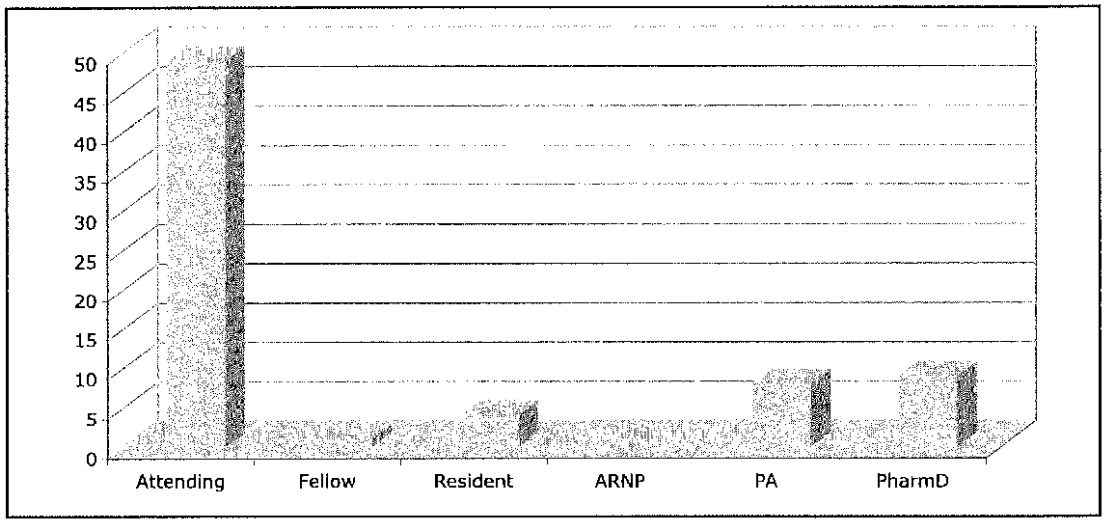

Figure 1: Survey Participants

The adjusted data was then stored in the same format as the original raw data, a copy of which can be found in Appendix C: Adjusted Data. Results and analysis were then performed on the adjusted data unless specifically stated otherwise.

6.3 Results

A total of 100 surveys were distributed, with 71 surveys returned (71%). Five of the surveys completed the front page only (Side A), leaving the back page (Side B) blank. Fifty-four of these represented physicians (76.1%) comprised of 49 Attendings (90.7% of physicians), 4 Residents (7.4% of physicians), and 1 Fellow (1.9% of physicians). Seventeen of the completed surveys represented 9 pharmacists (12.7%) and 8 physician assistants (11.2%). No surveys were returned from advance nurse practitioners.

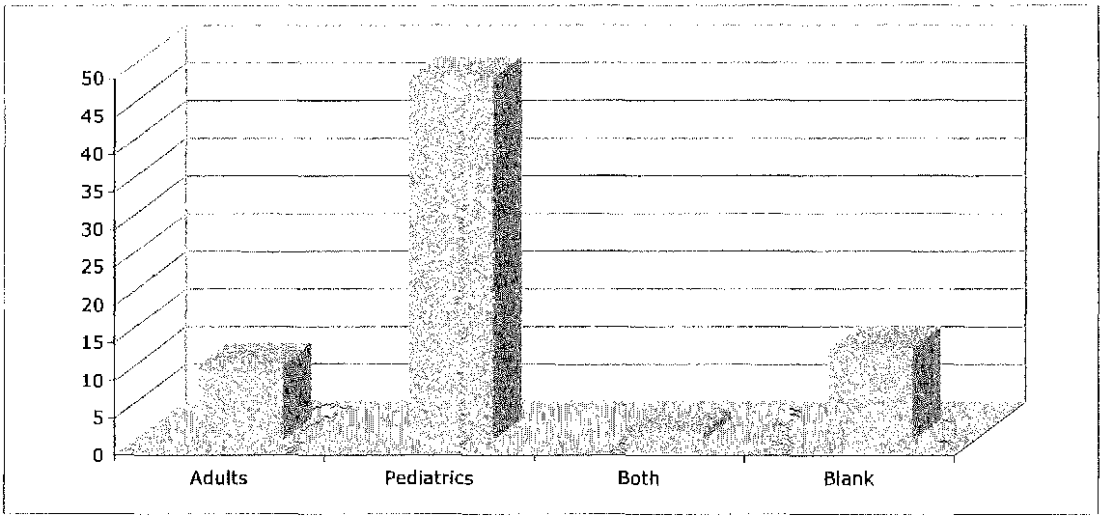

Figure 2: General Discipline of Participants

A breakdown of disciplines is presented in Figure 1: Survey Participants.

Ten responses were from physicians practicing in adult medicine, 48 from the pediatric disciplines, 1 from both disciplines, and 12 were unspecified. These numbers and percentages are represented in Figure 2 and Figure 3 respectively.

A wide range of specialties within each general discipline included 19 distinct practice types, with an additional non-specified result. Experience for each discipline is outlined in Table 1: Participant Experience by Specialty, representing a range from less than 1 year of experience to a high of 39 years of experience.

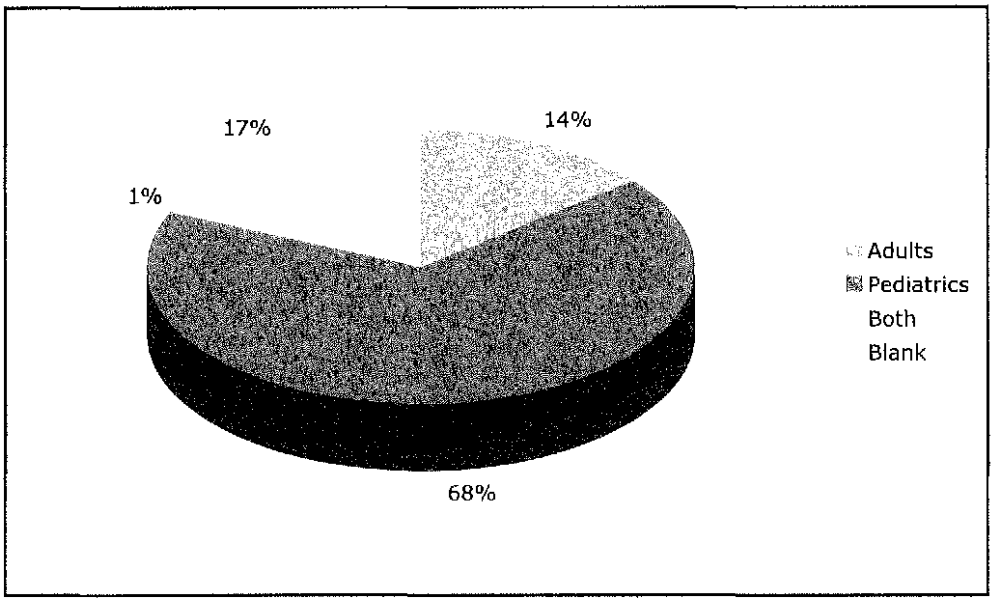

Figure 3: Discipline by Percentage of Participants

Statistical analysis of these results was performed using the Data Analysis Package for Microsoft® Excel for Mac®, version 11.1 (04090) for Macintosh Computers and compiled on a Dual PowerPC G4 machine running at 450 MHz with 756 MB SDRAM and 195 Gigabyte hard drive storage running Apple® 10.3.6 OS. Simple descriptive statistical analysis was used to explore the respondent demographic entries. Values were calculated when data was provided and omitted when fields were left blank or non-specified such as those surveys that did not enter years of experience.

Of all respondents, 33 were not considered hospitalists (46.5%), while 24 were (33.8%), with 14 choosing not to answer and a determination could not be made based on other information submitted (19.7%).

Specialty	Experience					
	Number	Mean	Medium	Mode	Standard Deviation	Confidence Level
Cardiac Disease	1.000	N/A	N/A	N/A	N/A	N/A
Cardiology - Pediatric	1.000	39.000	N/A	39.000	N/A	N/A
Critical Care - Adult	1.000	20.000	N/A	20.000	N/A	N/A
Critical Care - Pediatric	6.000	12.000	13.000	N/A	6.723	7.055
Emergency Medicine	1.000	12.000	N/A	12.000	N/A	N/A
ENT - Pediatric	1.000	15.000	N/A	15.000	N/A	N/A
Family Practice	4.000	11.000	11.000	N/A	5.773	9.186
Gastroenterology - Pediatric	3.000	20.000	20.000	N/A	3.000	7.452
General Surgery - Adult	1.000	12.000	N/A	12.000	N/A	N/A
Gynecology	1.000	N/A	N/A	N/A	N/A	N/A
Infectious Diseases - Pediatric	2.000	N/A	N/A	N/A	N/A	N/A
Internal Medicine	2.000	8.500	8.500	N/A	7.778	69.884
Neonatology	8.000	19.375	19.500	19.000	6.277	5.248
Orthopedics - Pediatrics	2.000	12.500	12.500	N/A	16.263	146.120
Otolaryngology - Pediatric	1.000	8.000	N/A	8.000	N/A	N/A
Pediatrics - General	20.000	11.950	10.500	1.000	9.991	4.676
Pulmonology - Pediatric	1.000	19.000	N/A	19.000	N/A	N/A
Surgery	1.000	21.000	N/A	21.000	N/A	N/A
Surgery - Pediatric	2.000	9.000	8.000	N/A	11.313	101.649
Unspecified	10.000	12.100	13.000	12.000	8.198	5.864
All Combined	65.000	13.815	15.000	1.000	8.824	2.186

Table 1: Participant Experience by Specialty

All 15 of those respondents who listed themselves as working in an intensive care unit (ICU) were considered hospitalists (21.2%), while 7 participants listed both floor and ICU (9.9%) as their primary site of practice. Twenty two participants (38%) stated their patients were mainly on the floor with 1 commenting that the term nursery was considered a floor (applied in this manner). The remaining 27 respondents left this field unanswered (30.9%).

Average number of in-patients per week had numerous responses with multiple corrections for variation to include patients per day. The range was 0 to as many as 120 (n=45, 63.4%) with 24 respondents (33.8%) choosing not to answer this question. Additional responses (2.8%) include "N/A" (n=1) and "varies" (n=1).

The next section of the survey consisted of 19 questions or statements to which the participant was asked to select on a scale of 1 to 5 based on their degree of agreement (5 = "agree strongly"), indifference (3 = "neutral") or disagreement (1 = "disagree strongly"). A response of 0 was meant to represent the "N/A" option for each statement. Frequency analysis of the responses are shown in Table 2: General CPOE Opinion Responses. Blank responses were not used in the histogram calculations and intermediate values were rounded up to whole bin numbers for purposes of analysis. The same information presented as a percentage of total responses can be found in Table 3: General CPOE Opinion Percentages.

Statement	N/A	Disagree Strongly	Disagree Moderately	Neutral	Agree Moderately	Agree Strongly
A	2	0	2	11	22	33
B	0	0	2	2	19	45
C	1	5	15	24	16	9
D	0	6	15	25	18	6
E	0	2	5	36	20	8
F	0	2	6	5	24	33
G	0	1	6	6	27	31
H	0	2	5	21	29	14
I	1	6	20	32	8	4
J	0	7	9	18	26	11
K	2	6	15	31	14	3
L	3	6	29	24	8	1
M	7	3	12	23	18	8
N	0	18	28	18	5	0
O	0	18	20	18	8	7
P	6	2	1	15	23	24
Q	1	2	6	19	19	21
R	1	2	3	15	29	21
S	0	1	0	6	19	45

Table 2: General CPOE Opinion Responses

The next section of the survey asked that the participant rank, in order of desire or importance, a list of several options. The ranges to rank were 1 to 5, or 1 to 3 with 1 signified the most desired or most important and 5 (or maximum of 3) signifying the least desired or least important. Although the original intent was have only 1 item selected at each level, several participants (n=10) made multiple selections at each

Statement	N/A	Disagree Strongly	Disagree Moderately	Neutral	Agree Moderately	Agree Strongly
A	2.9	0.0	2.9	15.7	31.4	47.1
B	0.0	0.0	2.9	2.9	27.9	66.3
C	1.4	7.1	21.4	34.3	22.9	12.9
D	0.0	8.6	21.4	35.7	25.7	8.6
E	0.0	2.8	7.0	50.7	28.2	11.3
F	0.0	2.9	8.6	7.1	34.3	47.1
G	0.0	1.4	8.5	8.5	38.0	43.6
H	0.0	2.8	7.0	29.6	40.9	19.7
I	1.4	8.5	28.1	45.1	11.3	5.6
J	0.0	9.9	12.7	25.3	36.6	15.5
K	2.8	8.5	21.1	43.7	19.7	4.2
L	4.2	8.5	40.9	33.7	11.3	1.4
M	9.9	4.2	16.9	32.4	25.3	11.3
N	0.0	26.1	40.6	26.1	7.2	0.0
O	0.0	25.3	28.2	25.3	11.3	9.9
P	8.5	2.8	1.4	21.1	32.4	33.8
Q	1.5	2.9	8.9	27.9	27.9	30.9
R	1.4	2.8	4.2	21.1	40.9	29.6
S	0.0	1.4	0.0	8.5	26.8	63.3

Table 3: General CPOE Opinion Percentages

level or some variation of this. Figure 4: Desired Usage Methods reflect the percentages for each selection.

Surveys that entered multiple selections at different ranks were treated as an equal level of desire or importance for analysis. Additionally, the polarity of the question weight was changed to present a more meaningful graphical representation.

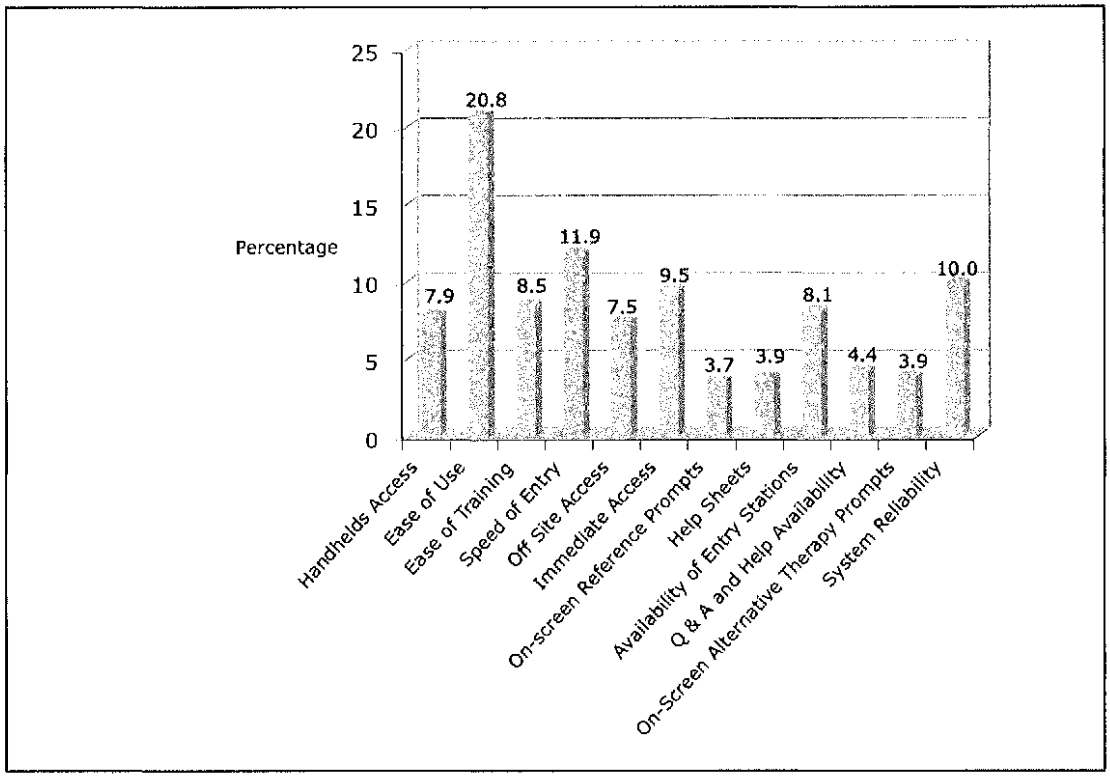

Figure 4: Desired Usage Methods

For instance, the least desirable was weighted least and the most desirable was weighted most; this was done by changing all "1" selections to "5," "2" selections were changed to "4," "4" selections were changed to "2" and "5" selections were changed to "1." Neutral ("3") selections remained unchanged. Figure 5: Desired Training Methods and Figure 6: Desired Support Modalities were both compiled in the same manner.

Finally, numerous respondents added comments, sometimes next to responses or just at the end. These are listed in Tables 4-5: Participant Comments, Part I & II, with notation for location of comment on survey.

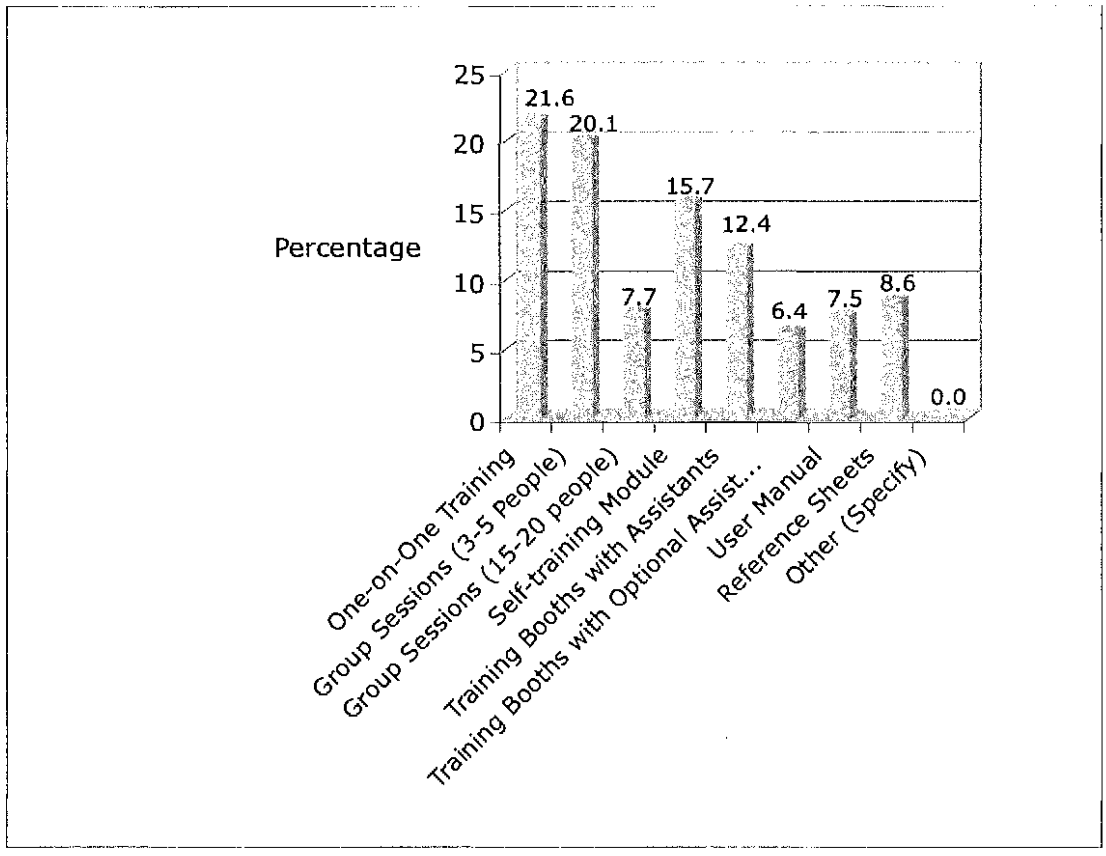

Figure 5: Desired Training Methods

The data were then stratified with respect to profession to determine if any trends could be readily discernable. Frequency for the responses to each of the statements under "Regarding CPOE" were first determine for all professions combined, an then individually for each profession. To help with clarity, "Fellows" and "Residents" were combined into one profession due to their similarity for this context.

Once a histogram for each statement was completed for each of the professions (and a combined professions group covering all responses), the results were then calculated as a percentage of total respondents from each group of professions. This was done to

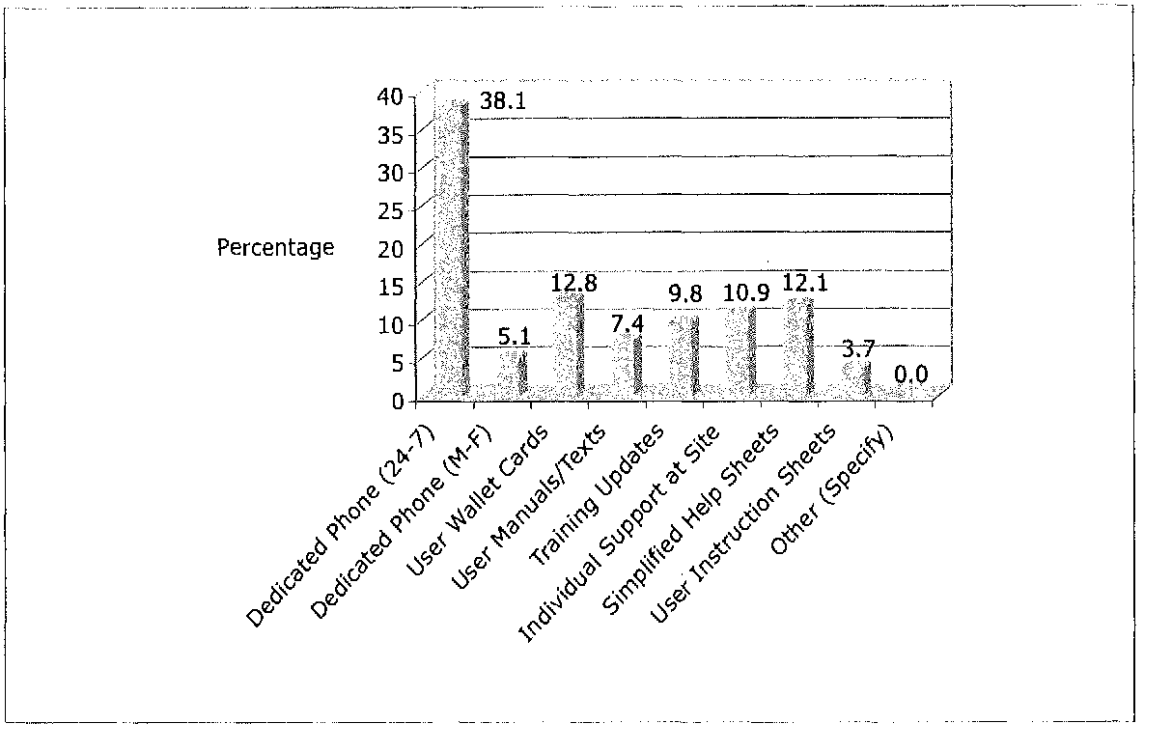

Figure 6: Desired Support Modalities

provide a relative equal weight for graphical comparison, however, and did not include analysis of reliability based on large number discrepancies from each group. Once converted to a percentage of response for each group of professions, this information was then plotted using simple graphical analysis in combination for comparison. Figures 6-10, 12-15, and 17-27 show the corresponding graphs for each statement.

A similar method was applied to the ranking questions; however, a combined group was not included since this information was graphically depicted earlier. Figures 11, 16, and 28 show the results of these calculations.

Where Entered	Comment
Comment Section	"Very promising & exciting system!"
Comment Section	"As we evolve toward a technology dependent system we must put in place safeguard. This must be a 'zero-defect' '100% error free' system – like airplanes!!!"
Comment Section	"This new technology seems less than perfected, but at least some version of it will be a standard in just a few years. I'm excited about the potential for standardization, therapeutic pathway development and the overall potential to improve patient care and decrease variation in care."
Comment Section	"System reliability & support will be key issues – No system is helpful if it is unavailable due to network or hardware failures. Also special populations' needs must be addresses (i.e. pediatrics and especially neonates – where very specific doses are required & frequently dosage forms are not available)."
Comment Section	"To me, a step backwards, relegation professionals to secretarial functions."
Comment Section	"Have enough stations available for peak use time."
Comment Section	"Personally, I am computer illiterate & will be part of the group needing tutoring."
Comment Section	"I'm afraid of computers!"
Comment Section	"Resident Training may be an issue for programs that have high resident rotation turnover."
Regarding CPOE – next "Core providers should be involved in CPOE design"	"What are core providers?"
Regarding CPOE – next "CPOE is generally easy to use"	"Don't' know."
Regarding CPOE – next "CPOE is generally easy to use"	"Don't' know."

Table 4: Participant Comments, Part I

Where Entered	Comment
Regarding CPOE – next "If available, I would definitely use CPOE"	"Don't' know."
Regarding CPOE – next "In general, I feel CPOE is beneficial"	"How would I know?"
Regarding CPOE – Next to "CPOE is generally easy to use"	"Not initially at all"
Regarding CPOE – Next to "In general, I feel CPOE will require less time"	"Not initially"
Regarding CPOE – Next to "In general, I fell CPOE will decrease my work"	"Not initially"
Regarding CPOE Training – Next to "Group Sessions (15-20 people)"	"NO! People do not learn in large groups – look at orientation"
Regarding CPOE Usage	"1 Bedside Computer"
Regarding CPOE Usage	"*Need a clerk to enter"
Regarding CPOE Usage – Next to "Questions & Help 'Hotline' Availability"	"If this is needed the systems is a failure"
Regarding CPOE – Next to "CPOE will expand my ordering options"	"(PharmD")

Table 5: Participant Comments, Part II

6.4 Analysis

From the onset, it should be noted that this study was designed to only illicit opinions and responses from physicians. Due to the difficulty in obtaining physician responses,

attempts at validation and validity were abandoned in preference for numbers of completed surveys. Any prolonged attempt at surveying physicians or requesting repeated surveys from the same physician would have significantly diminished the physicians' willingness to participate.

With this in mind, it becomes necessary to understand the limits of the information provided and the context of our use. Extensive detailed statistical analysis, while helpful when trying to prove significance for numerous factors of dependence and codependence of variable responses, in this case lacks the necessary foundation required to establish validity and therefore was not included.

Simple frequency diagrams with bi-variant graphing provided the most objective information in a meaningful manner from which several inferences can be made. This was the basis for our approach to the physician responses.

Since the survey was primarily directed towards physicians, it is not surprising the majority of our surveys were completed by physicians (76.1%). It is also not surprising that most of these physicians are involved in the field of pediatrics (68%), as the bulk of the surveys were distributed in Wolfson Children's Hospital.

When the number of years of experience is examined, a wide range is noted from only a few months to as many 39 years. This is reflective of an academic environment where there are young physicians in various phases of training being supervised and

educated by more experienced physicians. Combine this with a setting of private practices and numerous established group practices, and the preponderance of experience will be on the more experienced side. The study sample showed an overall mean experience of 13.8 years (Table 1: Participant Experience by Specialty).

The question of "hospitalist" produced interesting responses. As stated earlier, the intent of this study was to include those physicians whose primary function was caring for patients in the hospital setting under the category of "hospitalist." This definition has not been widely accepted within the pediatric community as evident by numerous pediatric intensive care physicians whose answers reflected that they did not view themselves as "hospitalists." During an informal verbal communication, one of these physicians stated, "hospitalists take care of other doctors' patients. I take care of my own patients." This correlates with earlier mentioned studies showing the reluctance of physicians to readily forego the personal communication of the physician-patient relationship in exchange for the more corporate, government control relationship [Anderson90].

The information requested regarding "ICU" versus "floor" and the number of average patients cared for over a period of time were intended to determine if those physicians more involved in ICU settings, where presumably the acuity and therefore the number of orders would much higher, had differing views towards the use of CPOE systems. With the same thoughts, the attempt was to determine if those physicians who had seen more patients than in a hospital setting would have different views towards

CPOE systems. Unfortunately, due to the extremely wide range of responses and the large number of blank responses, no meaningful correlation could be determined to either support or disagree with these hypotheses.

The most useful results were derived from the physician responses to the series of statements and their ranking of priorities for usage, training, and support of CPOE systems for physician use. When reviewing the initial responses collectively from all professions, it becomes readily apparent that the overwhelming concern is ease of use (Figure 4: Desired Usage Methods). This is followed next by speed of entry, system reliability, and immediate access.

These findings support the previously mentioned statements about physicians' concerns about time. Associated with this is the earlier described concept, of avoiding disruption to physicians' workflow. Any change in the workflow, be it from searching for a computer terminal to enter orders, or waiting for the system to become active online, or trying to muddle through multiple prompts and on-screen dialogs to make a simple entry could represent a significant change to the physicians' workflow. The accumulative affect of these changes could be verbalized as "it takes more time" but the underlying etiology remains a change to their workflow.

It is this fear of requiring more time to complete their daily tasks that is an underlying turbulence to any acceptance of a CPOE system by physicians. This is reflected when

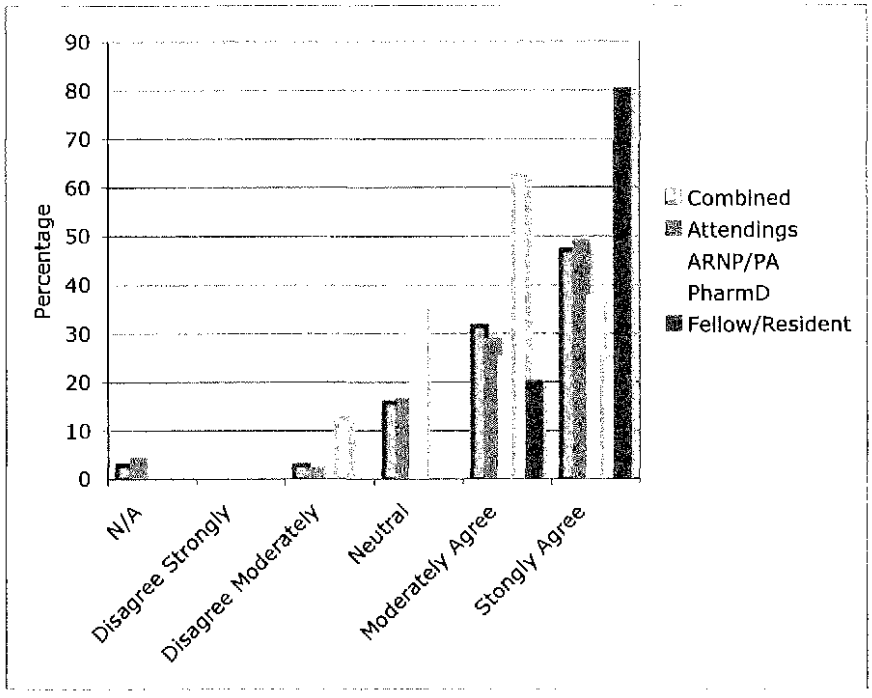

Figure 7: CPOE is Beneficial

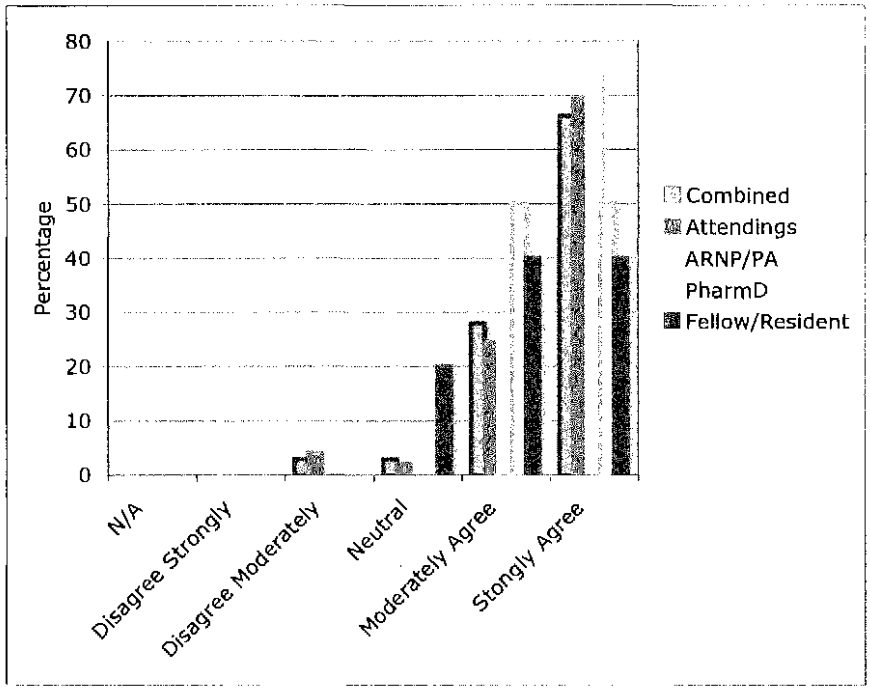

Figure 8: CPOE is Inevitable

physicians were asked very specifically if they thought CPOE would decrease their work. Despite overwhelming feeling CPOE was beneficial and ultimately inevitable (Figures 7-8), the vast majority of physicians did not feel CPOE would decrease their work, nor did they feel it would require less time (Figures 9-10).

If the physicians could be shown that the time constraints are not accurate, they may be more adapt to use the technology. This is consistent with previous studies that have suggested an actual increase in the number of physicians who embrace a wide variety of newer technology, as long as that technology provides a clear value for them [Hamilton03].

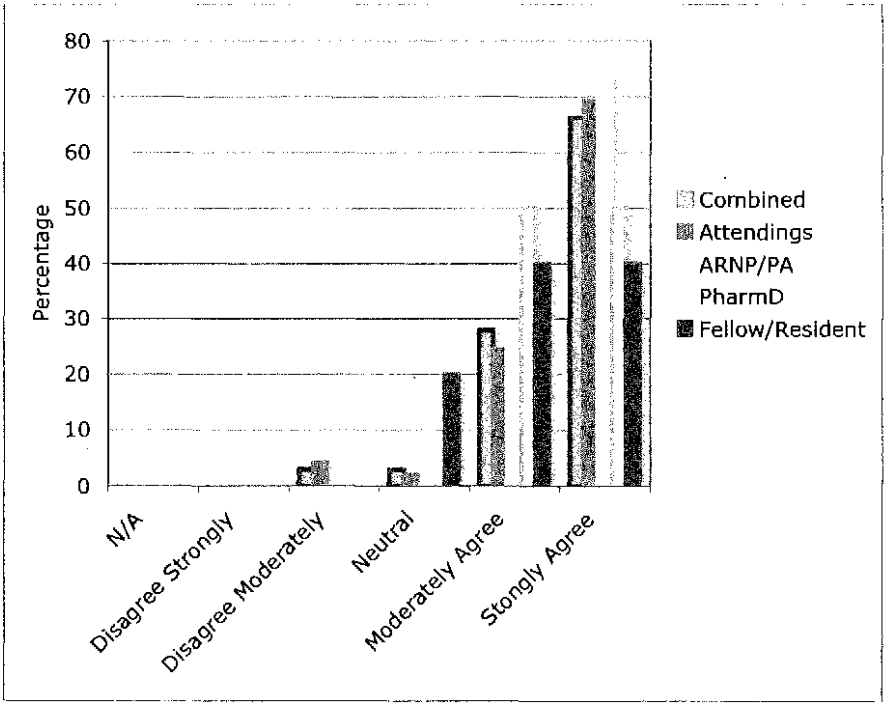

Figure 9: CPOE Will Decrease My Work

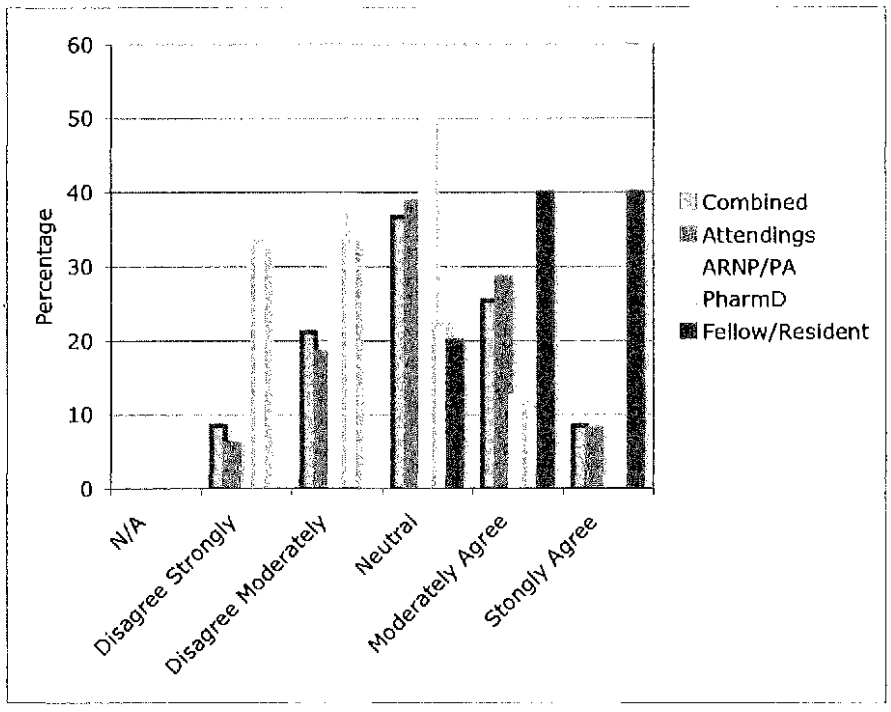

Figure 10: CPOE Will Require Less Time

One of the ways to insure CPOE systems have ease of use is to insure minimal, if any, disruption of the physicians' workflow. At Loma Linda University Medical Center in Loma Linda, California, the CPOE system was designed with the goal of improving the physicians' workflow, with no intent of turning physicians " ...into unit secretaries" [Rogoski04]. Policies such as these that are verbalized and stressed to the physician staff help with successful implementation and immediately address concerns such as the one listed in the comment section of one survey stating, "To me, a step backward, relegation of professionals to secretarial functions" (Table 4: Participant Comments, Part I). When Intermountain's Institute for Healthcare Delivery and Research rolled out its CPOE system, hospital staff readily admitted their biggest

challenge was to truly blend the computer system into the doctors' workflow, a directive that helped their system succeed [Benko03].

Still, hospitals must be very cautious in balancing the needs of one group of users with other users. The whole notion of what constitutes usability for health care professions can be disputed and suggests a differing level of needs based on users' training, background, computer skills, and professional roles [Gosbee97]. Understanding cultural and professional difference not only within any given health care delivery system, but accounting for variation across different regions and specialties can be very daunting. John Gosbee, in a perspective discussing the human-interaction and medical software development, suggests a lack of understanding of these differences leads to poorly usable systems that do not address physicians' workflow (or others) and leads them to not accept the technology – something he feels is often wrongly attributed to physician arrogance and age [Gosbee97].

Claus Bossen studied the interaction between various health care providers such as nurses and physicians to evaluate the use of a common work space and determined, in part, the need to use specialized "packaging" of differing functionality for each of these groups [Bossen02]. This is most clearly represented in Figure 11: CPOE Usage Preferences by Profession. Here there is a wide diversity of preferences, once split into differing professions.

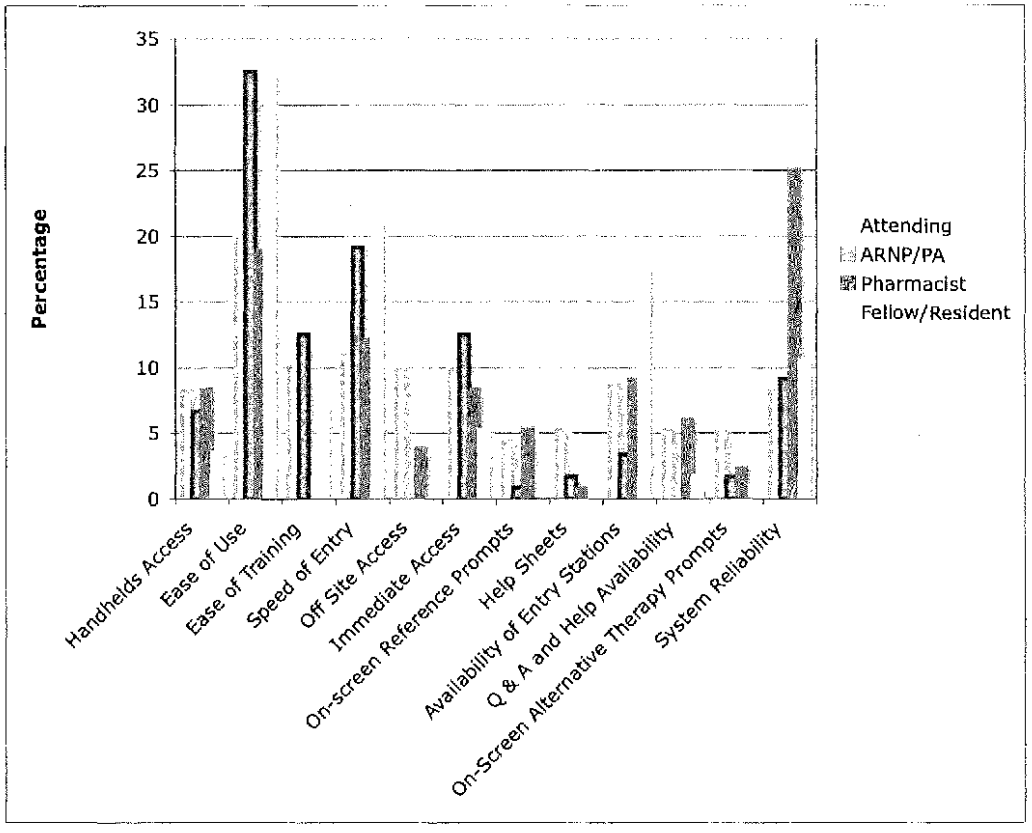

Figure 11: CPOE Usage Preferences by Profession

The most glaring difference is the need for system reliability expressed by pharmacists as the most important priority, versus the need for ease of use listed by attending physicians as the most important priority. On reflection, this might be related to the basic knowledge that CPOE systems, while relatively new to physician users, have long existed in one form or another in pharmacies for many years due to computerization of dispensation both institutionally and commercially. Perhaps pharmacists experiences with prior systems suggest reliability and system downtime was more of a hindrance than user-interface issues. This would seemed to be reflected in several comments made by pharmacists that include; "this new technology seems

less than perfected, but at least some version of it will be a standard in just a few years" and "system reliability & support will be key issues – no system is helpful if it is unavailable due to network or hardware failures" (Table 4: Participant Comments, Part I).

Other promising technologies to improve physician acceptance include the use of alternative entry methods such as PDA and pen-based data entry pads. An early electronic medical record prototype project that was developed at University of Southern California Medical Center was tested in the newborn nursery. The prototype used a pen-based system with portable devices appealing to the convenience and portability of the pen and paper paradigm. This was found to be much more user-friendly and gained wider physician acceptance due to the simplicity of use and design [Lincoln94]. Interestingly, the use of handhelds was not a significant priority in our collective data nor did any of the professions seem to desire this modality over other preferences. However our survey was specifically limited to the order entry component (Figure 11: CPOE Usage Preferences by Profession). If the survey was expanded to include the electronic medical record, the desire for handheld access and the need for off-site access might significantly increase.

Other aspects of these systems which can be offered to physicians to "prove they are of worth" include the ability to provide physicians with readily available information at their finger-tips for a more informed decision. Traditionally, although the patient's information is kept in a single chart located somewhere on the nursing unit, the very

nature of medicine and reporting requires this information to somehow make its way back to the chart in a timely manner (usually in printed form) for the physician's review. Invariably, reports are late, missing, or not available, which prevents them from getting into the chart in a timely manner.

The CPOE system has the potential to provide all this information in a real-time updated manner, allowing the physician to make a more informed decision about therapy and possible intervention. Fred Baldwin from Healthcare Informatics explains that one of the keys to physician acceptance of CPOE is adding the system as a capstone to a simpler foundation that makes clinical patient data available electronically at the site, when physicians are still making patient care decisions [Baldwin04].

Beyond providing up-to-date and timely clinical patient information, another promising technology often offered to physicians as a means to help improve their workflow is the use of online references. At the simplest level, the CPOE system would allow the physician to link to available references already used by most physicians. At the more intuitive level, prompts would be provided based on context, such as alternative medications when ordering a medication. Prompts to suggest alternative dosing based on concurrent therapy or patient disease could also be provided.

It was the use of this technology that gained physicians' willingness to participate in system use and further development with the Veterans Administration CPOE system introduced in 1995 [Cutolo98]. Physicians who were described as "frequently hostile" toward the system became eager participants once they learned how the system could improve their workflow and efficiency. However, these "help" functions must be designed with care. Examination of how physicians extract information is often nontraditional in the academic sense [Florence95] and must be closely developed with physician involvement.

When developing these interfaces, some have even advocated the video taping of the physicians' interaction for visual clues allowing for a more accurate assessment of usability and successful interface design [Kahn98]. The question of physicians' willingness to participate in both design and training of CPOE systems was overwhelmingly put to rest with the majority of all professions agreeing to participate in design and training of these systems (Figures 12-13). Additionally, when asked about the relevant importance of having core providers (i.e. physician users) participate in CPOE design, nearly all respondents felt strongly this should be done (Figure 14: Core Providers Should be Involved with Design). This should eliminate any concern about physicians' willingness to participate in design efforts.

An often suggested improvement to physicians' workflow is the use of pre-designed order sets. These are usually evidence-based protocols that have been developed to insure compliance to institutional guidelines in patient care management. It is these

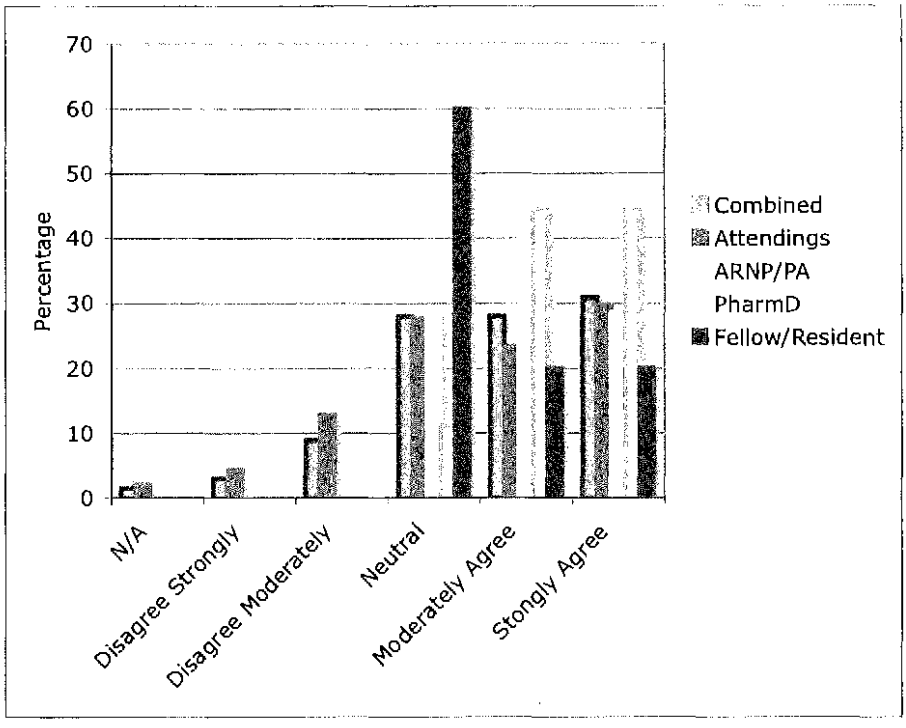

Figure 12: I Would Participate in CPOE Development

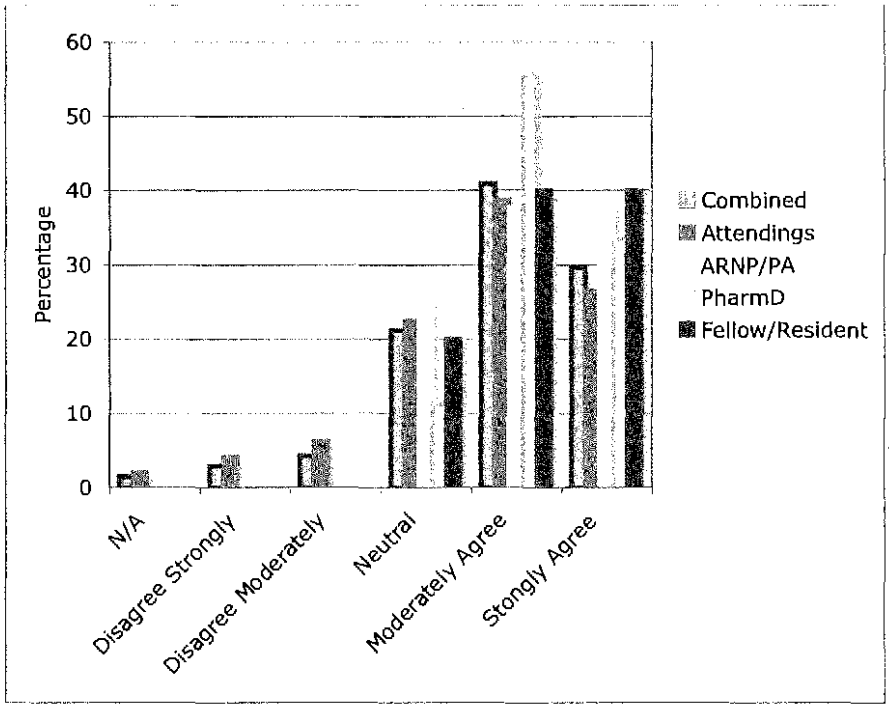

Figure 13: I Would Participate in CPOE Training

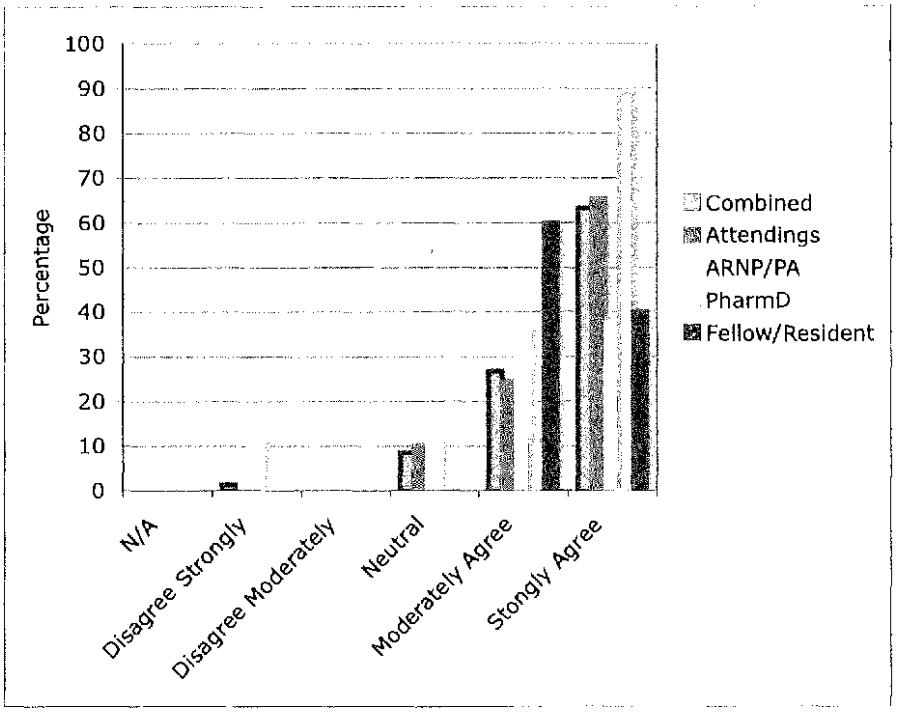

Figure 14: Core Providers Should be Involved With Design

customized clinical decision support rules that provide CPOE's greatest institutional and individual asset [Scalise02B]. These protocols also provide consistency across networks and presumably limit liability for the physician and institution by providing set guidelines and mandating that a certain standard of care be met which has already been determined to be a best-practice standard [Schuerenberg03].

Yet it is these same standards that most clinicians balk at when trying to develop; new practices are seen as another intrusion into the physician-patient care autonomy [Brigss04B]. Although once agreed upon and activated standards can decrease the time required to admit a patient to the hospital, the development and consensus building to reach acceptable rules for standards can be arduous and enduring. When

the data are examined, most providers felt CPOE systems would indeed decrease their liability with a notable strong exception from the pharmacists (Figure 15: CPOE Will Decrease Provider Liability). This perception might be related to the additional responsibilities of the pharmacy with regards to potential liability beyond the actual prescribed order, such as medication identification, packaging, and dispensing. CPOE, though helpful indirectly with some of these functions, does not address internal pharmacy needs comprehensively.

In contrast, however, responses to questions designed to elicit their views on restriction of ordering options and limits on their autonomy were relatively neutral, suggesting most physicians do not have strong feelings that CPOE systems will limit

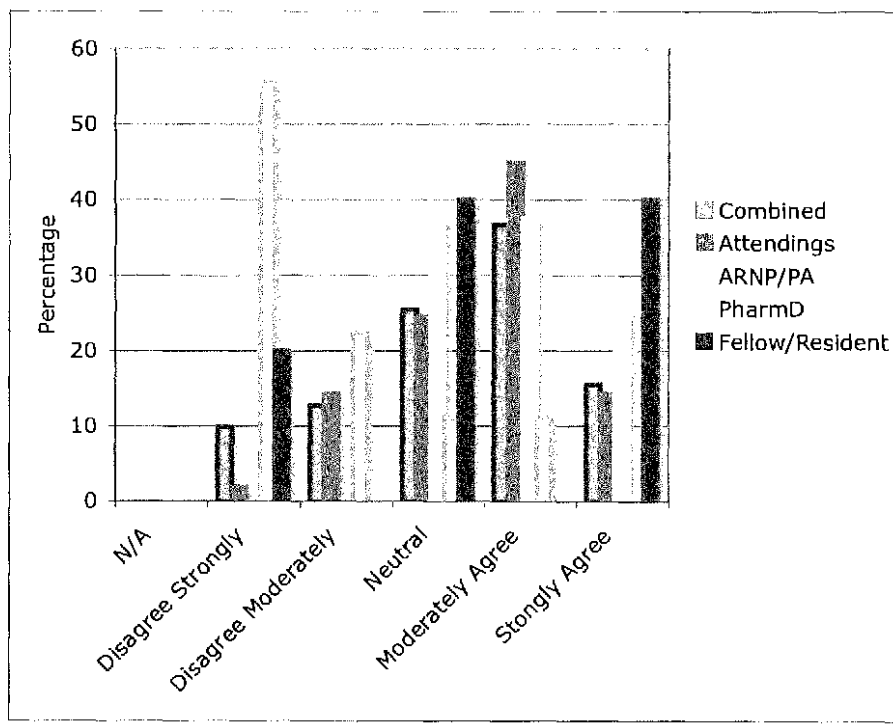

Figure 15: CPOE Will Decrease Provider Liability

their ability to practice through either available order options or standard of care, best-practice protocols. Perhaps for these same reasons, pharmacists also were the exception to feeling CPOE would decrease their work and require less time, with the majority disagreeing with that statement (Figures 9-10).

The training of physicians in the combined profession group showed a clear preference for one-on-one training with small group sessions of three to five people selected as the next most desired method (Figure 5: Desired Training Methods). Other popular methods included self-training modules and training booths with assistants readily available. Not surprisingly, large group sessions and the use of manuals were the least desired approaches. As early as 1991, Marc Rettig reported the well-known fact that most user manuals were never opened until there was a problem or a function physicians could not solve on their own [Rettig91]. Even then, the use of a manual to solve the problem was generally viewed as a failure of interface design.

Desired support once a system was implemented again was clearly delineated; the vast majority felt dedicated phone support, available 24-hours a day, seven days week, should be provided. Reflecting on previous discussions of concerns for change in workflow and resultant time considerations, it can be readily apparent why this was given such a high priority. Inability to complete an order or perform a required patient care task can be seen as an unwritten fear through the expression of the need to have access to answers immediately, whenever needed.

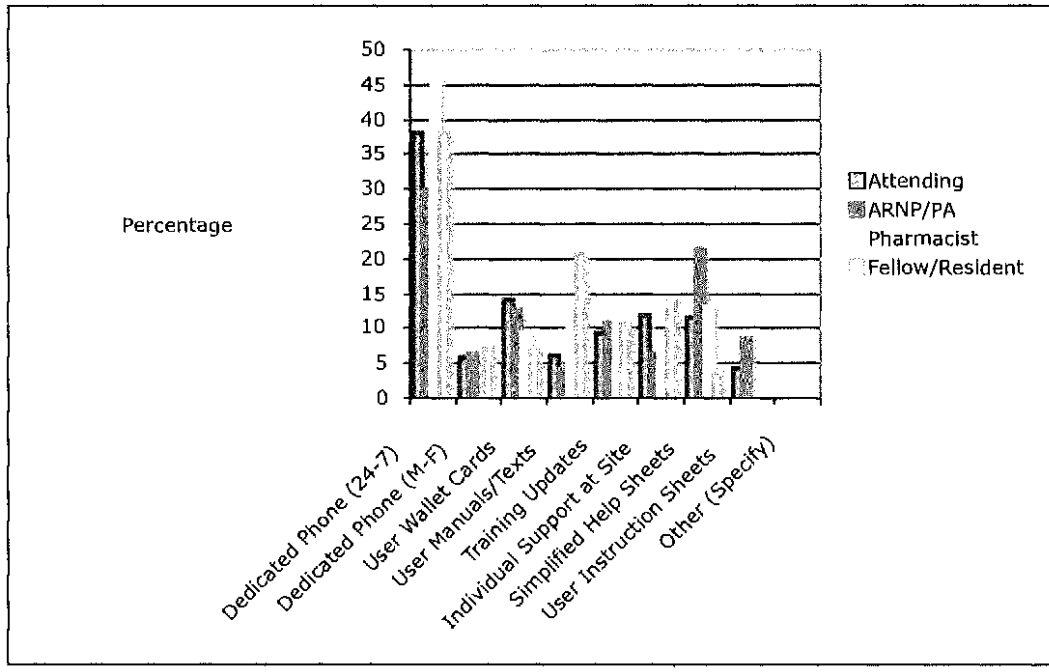

Figure 16: CPOE Support Preferences by Profession

The second most popular desire for support option, although nearly 50% less than that of 24 hour support, was the use of cheat sheets or wallet information cards (Figure 16: CPOE Support Preference by Profession). These are small, concise information reminders for basic functionality that have long been used in hospital settings for other systems such as the dictation and operative report systems.

Other generalized inferences from our data suggest most physicians readily agree CPOE systems will decrease the need for order clarification, decrease errors, and help improve patient outcomes somewhat (Figures 17-19). All of these collectively have the potential for decreasing patients' length of stay and increasing patient satisfaction,

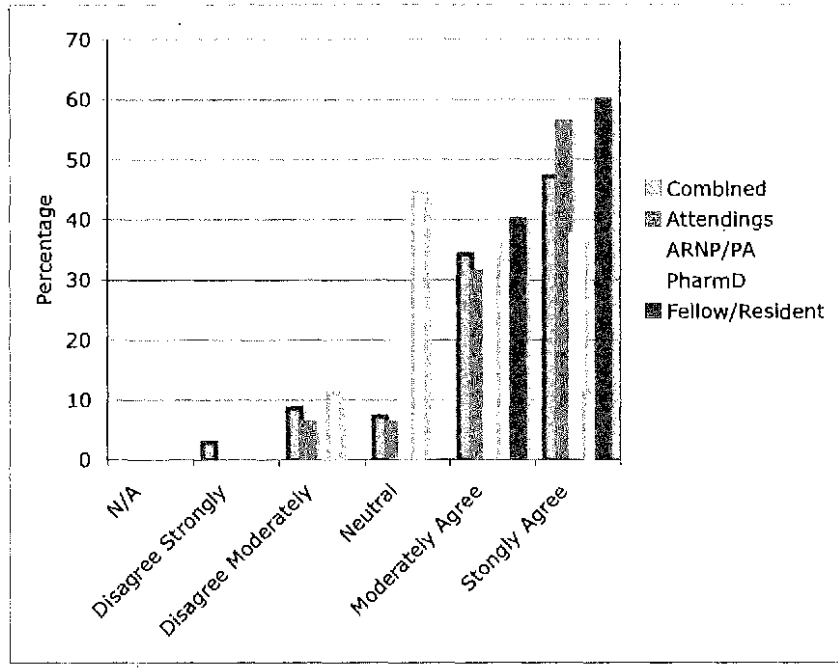

Figure 17: CPOE Will Decrease Need for Order Clarification

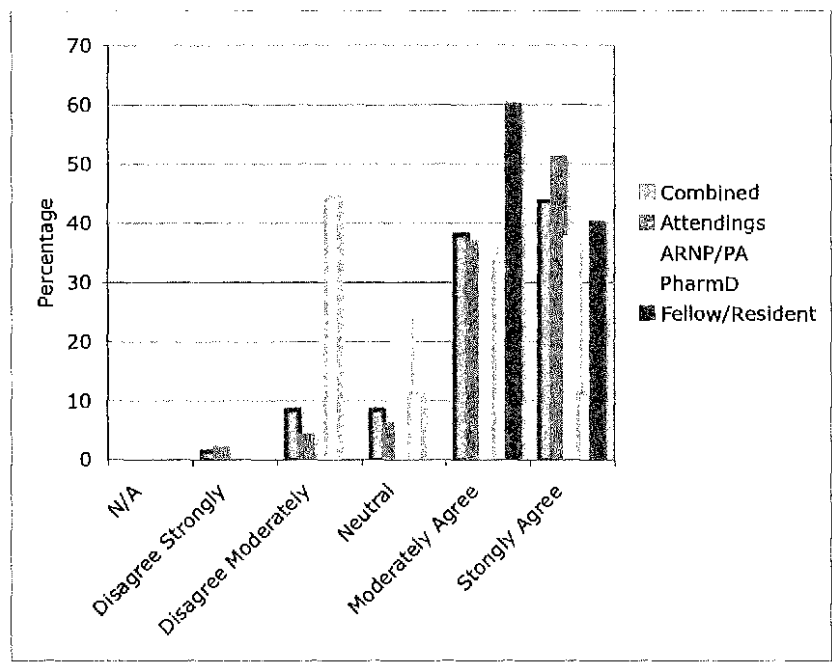

Figure 18: CPOE Will Decrease Order Errors

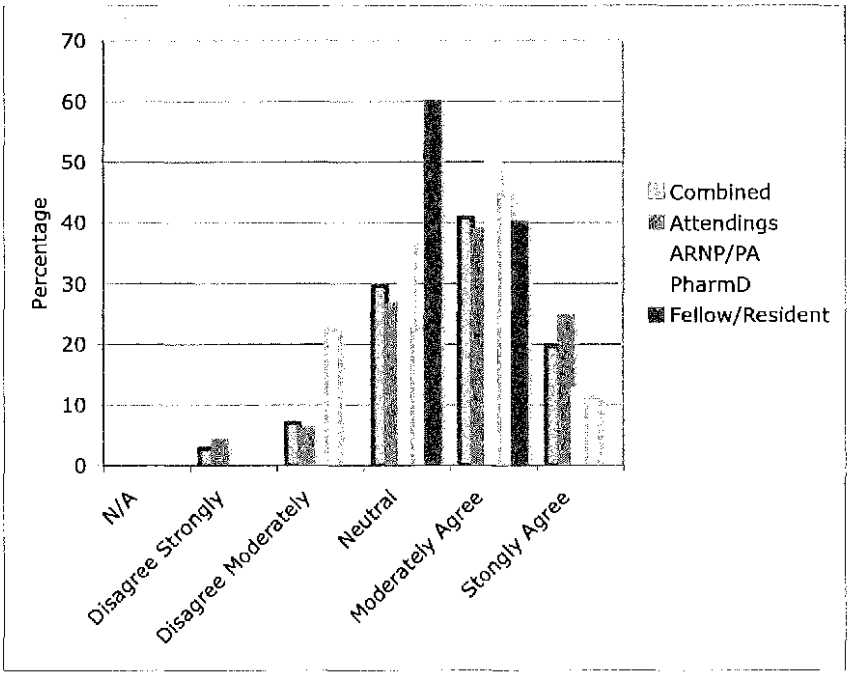

Figure 19: CPOE Will Improve Patient Outcomes

which was also reflected in our data (Figure 20: CPOE Will Improve Patient Satisfaction and Figure 21: CPOE Will Shorten Length of Stays). A corollary to this is that most physicians did not feel CPOE would cause a hindrance to care, expressed by most physicians disagreement with the statement, "CPOE is a hindrance to patient care" (Figure 22: CPOE is a Hindrance to Patient Care).

Finally, when physicians were asked explicitly if they would use CPOE systems and if they felt these systems should remain optional, some surprising results were revealed. Most physicians disagreed that CPOE systems should always be optional, although

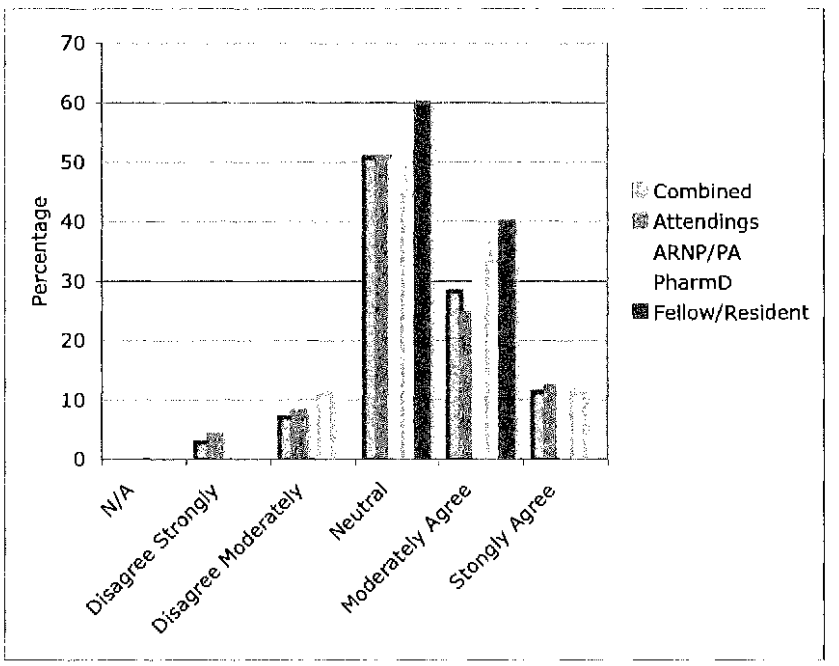

Figure 20: CPOE Will Improve Patient Satisfaction

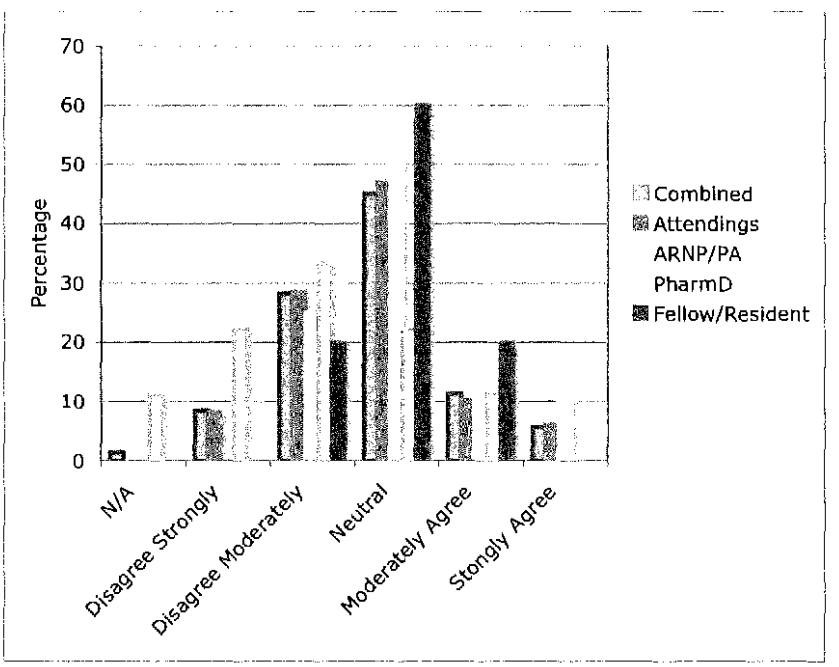

Figure 21: CPOE Will Shorten Length of Stays

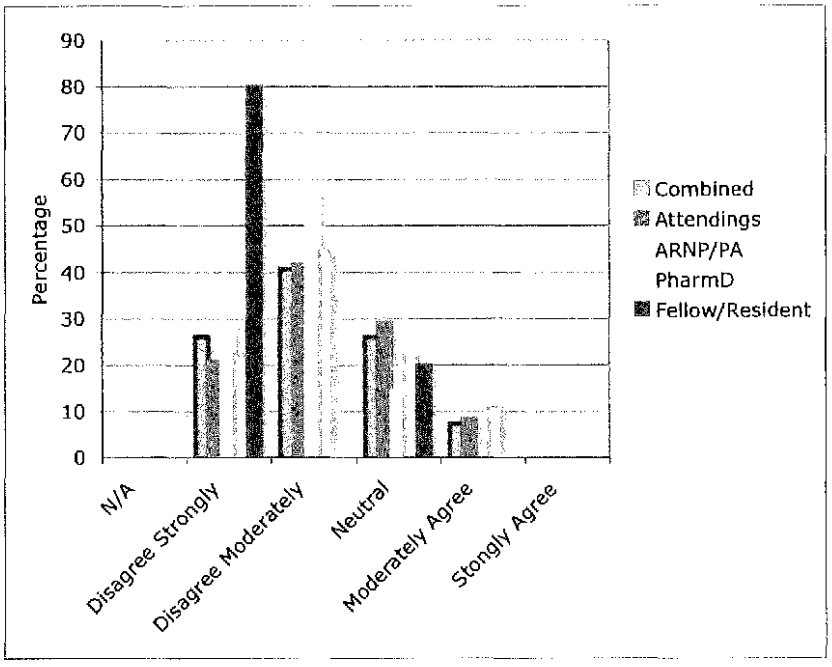

Figure 22: CPOE is a Hindrance to Patient Care

responses were across the full spectrum of possible options (Figure 23: CPOE Should Always be Optional). This suggests physicians have more insight into purpose and need for such systems then they are traditionally granted. When broken down into separate professions, the pharmacy and fellows or residents seemed much more likely to disagree that CPOE systems should be optional.

The final question of physicians' intent to use these systems based on their current understanding clearly suggests most are willing to adopt this technology (Figure 24: I Would Definitely Use CPOE). This could be a reflection of the increased pressure in the medical community to move this direction or the heightened awareness of the

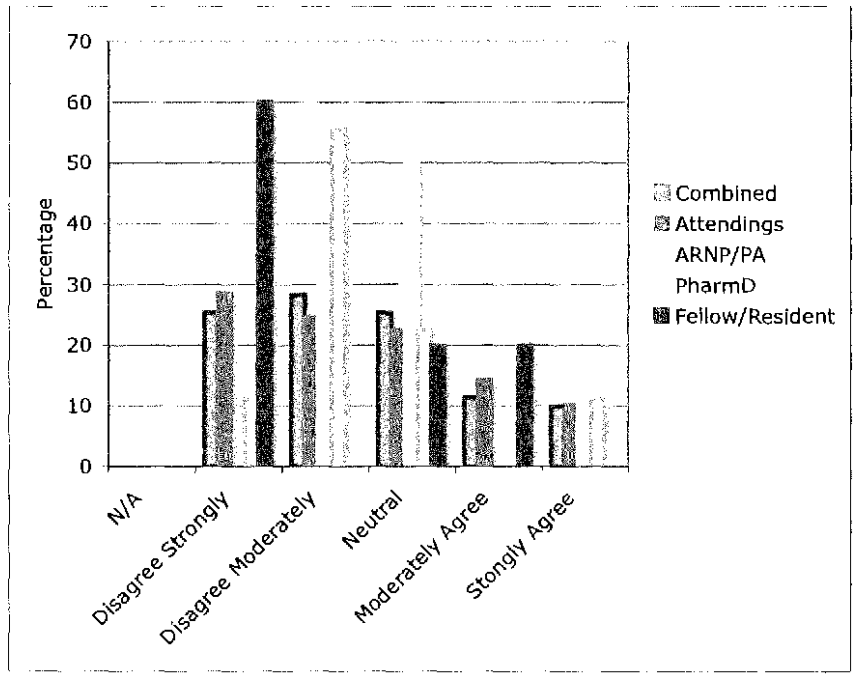

Figure 23: CPOE Should Always be Optional

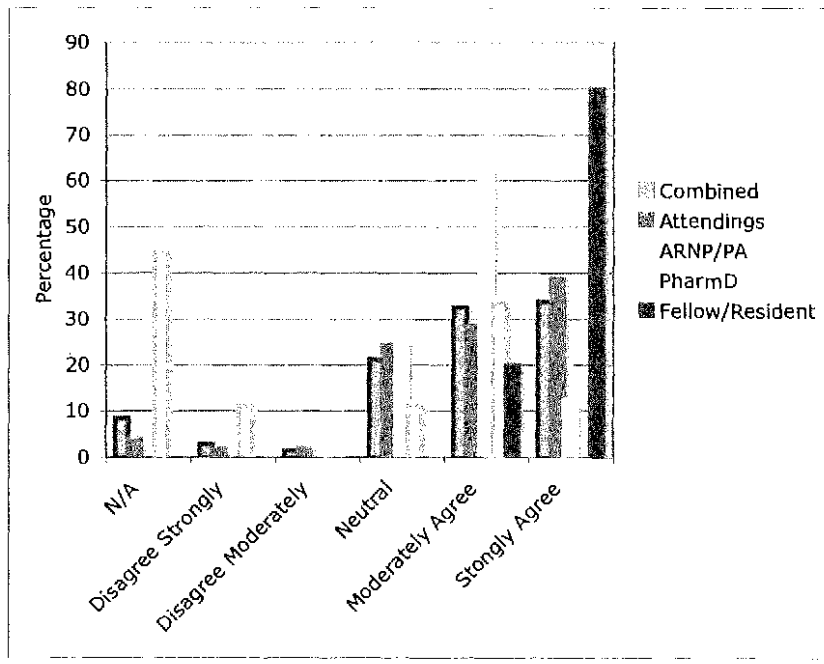

Figure 24: I Would Definitely Use CPOE

institutions surveyed. Regardless of the underlying etiology, the generalized notion that most physicians are reluctant to adopt CPOE technology does not appear to be true for our sampled population.

Additional results showed most physician were "neutral" with respect to ease of CPOE use (Figure 25: CPOE is Generally Easy to Use). Physicians surveyed also did not feel CPOE would limit their autonomy (Figure 26: CPOE Will Limit Autonomy), nor expand ordering options (Figure 27: CPOE Will Expand Ordering Options).

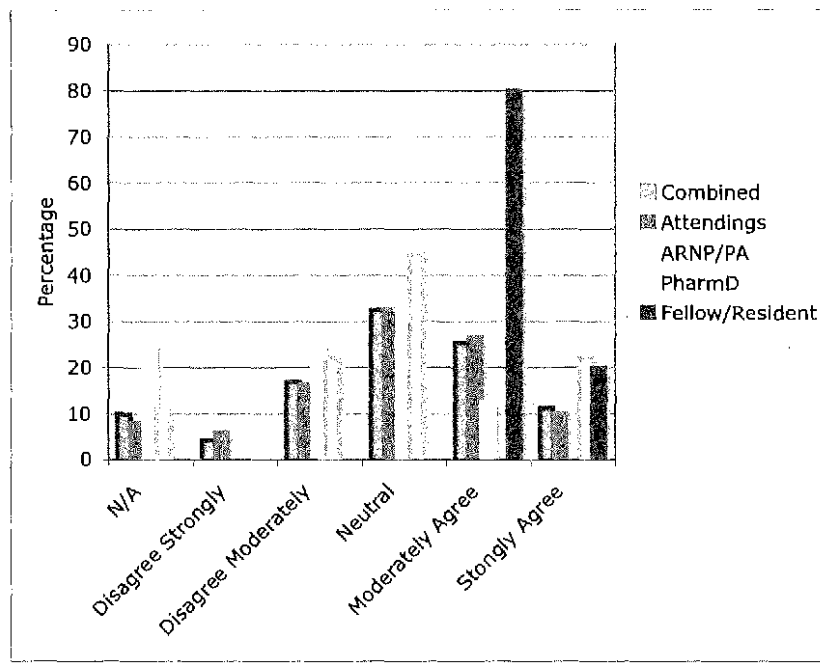

Figure 25: CPOE is Generally Easy to Use

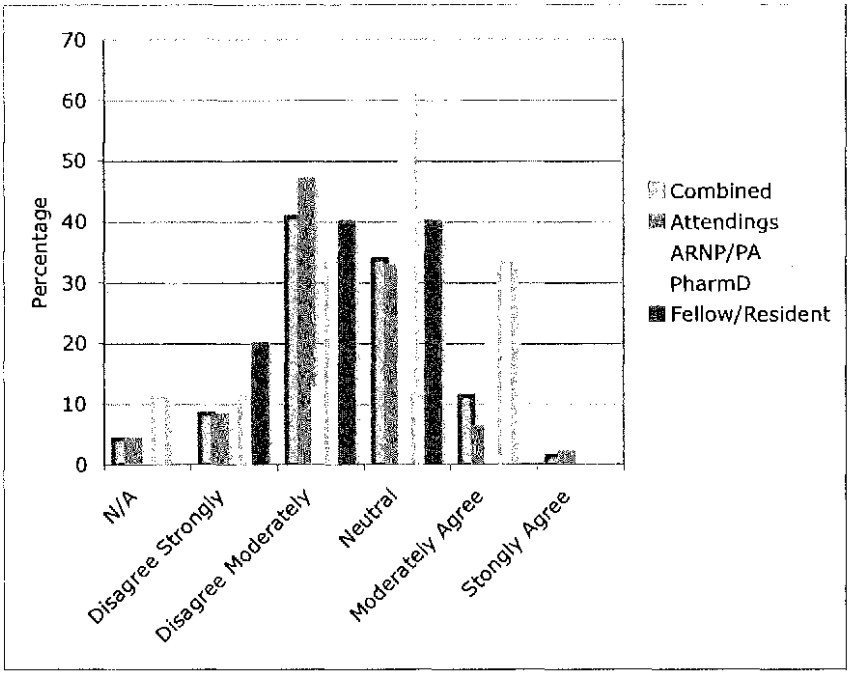

Figure 26: CPOE Will Limit Autonomy

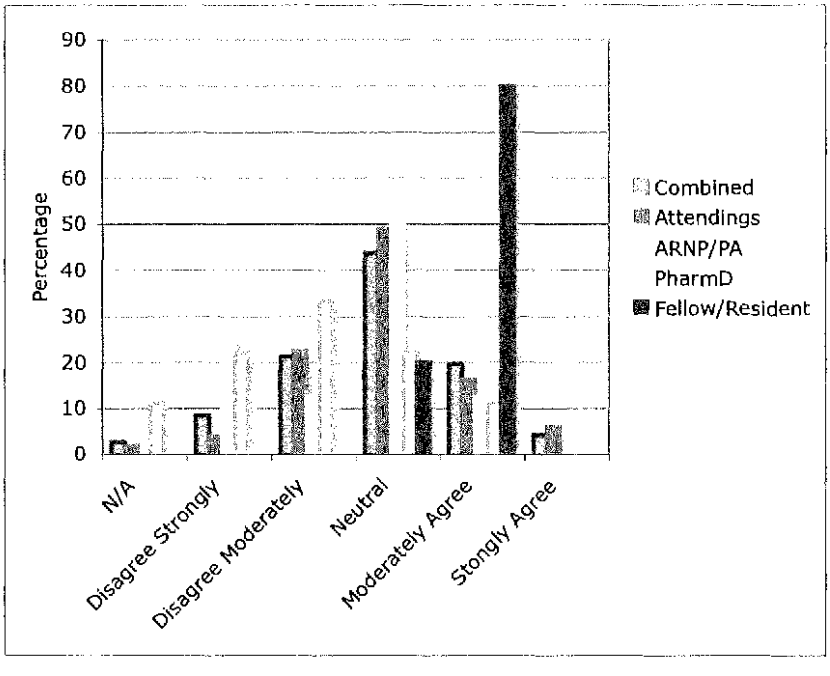

Figure 27: CPOE Will Expand Ordering Options

Chapter 7

DISCUSSION

Although helpful in many aspects, the data did suffer from inherent errors and limitations. These are discussed below in addition to suggestions for improvements should a more extensive study be considered.

7.1 Critical Review

While the data have helped support and refute many claims regarding CPOE acceptance within our physician sample, there were areas for improvement. As with any survey, the longer the surveys are circulated and the more assistance provided to assist in their completion, the more likely there will be a successful response. The clear definition of terminology, completion instructions, and availability of a knowledgeable person on site to answer any questions would help with the return of surveys.

While the majority of surveys were distributed through participation in group meetings and events where the bulk of physicians could be physically handed a survey and given a personal request asking for completion, certain areas merely had the surveys

available as handouts for those interested. Obviously these areas had a much lower response rate than individual interaction.

Unfortunately, the realities of medicine prevented this level of support and required balancing the need for physician participation with the need to prevent an overwhelming form, which at first glance might be discarded by any potential physician participants. Information should be concise and clearly legible. Despite the researcher's best efforts and several sample survey requests, there was some information that was not captured that might have shed some additional insight into the physicians' responses.

The first of these would have been some indicator of the physicians' computer knowledge and expertise. Presumably, those surveyed included some very familiar with computers as well as some less familiar. Comfort and usability are certainly related to the users' satisfaction and would undoubtedly have provided a further level of stratification that might have produced some differing results. Without this information, the data must be interpreted as a whole without assumptions about level of expertise or experience.

Clarity of definition might have helped avoid confusion, especially with relation to those terms that remain discipline specific, such as "hospitalist." The average patient-per-week question was very open-ended and did not have the specificity needed to correlate responses. The whole notion of numbers of patient and numbers of orders

each physician was potentially responsible for might have opened additional areas of exploration of attitude trends between the various practicing physicians.

As with any method of surveying, the reliability and validity of the surveys should ideally be assessed before any proper evaluation can be determined. As discussed earlier, the restraints on physicians' time and availability limited this study; and when evaluated for potential usable responses, the data was used "as is" with no inferences into validity.

Another important determinant was the denominator of physician responses. The total number of possible physicians who had an opportunity to complete the survey was unobtainable due to the methodology by which the surveys were obtained and because of having multi-facility responsibilities. Due to these reasons, conclusions about sample size and representative meaning could not be ascertained.

Finally, the very nature of self-reporting must be realized as not ideal and should be interpreted with caution. Ward et al. discusses the importance of limiting the significance and reliance on physician self-reporting for adherence of behaviors [Ward02]. The results should be interpreted while keeping of these limitations in mind.

7.2 Recommendations

Despite the above limitations, certain conclusions can be readily assessed based on our data. First and foremost is the assumption that most physicians are reluctant to accept CPOE technology. The data do not support this, at least in the surveyed domain. The survey results found most physicians felt CPOE systems were beneficial, ultimately decreased work, and may reduce the time required to place orders. They also felt that CPOE systems would reduce requests for order clarifications, reduce medication errors, and improve patient outcomes slightly. This would result in shorter patient length of stays and improved patient satisfaction. The reflection of this knowledge through their responses also suggests physicians have much more insight into CPOE technology than traditionally given credit.

Realizing the physicians have a much greater understanding than previously acknowledged suggests efforts that concentrate on trying to education physicians on the relative merits of CPOE systems might not need as high a priority and should not be the basis for seeking physician acceptance.

What was of significance to the sampled population was the need for ease of use, which was determined to be reflected indirectly by changes to their workflow. These findings were accompanied by a need for physicians to see user worth (i.e. something tangible that will decrease their time and improve their workflow) and improved efficiency in their patient care process. On the surface this sounds relatively simple,

but our data show this "improvement" must be closely developed in conjunction with physician users and repeatedly revamped based on feedback and interaction.

Practically, demonstrations of such systems should involve the use of actual physicians (supporting the physician-champion methodology used by many hospitals) and should be concise and limited. Displaying an overwhelming number of options to a novice computer user would not portray user-friendliness and could be overwhelming. Additionally, requiring extensive amounts of time to do something that could be done in a few seconds with a pen and paper would not be the ideal choice. Returning to the core principle of time equals workflow, demonstrations should be focused on potential improvements such as clinical patient information readily available, automatic dosage calculations and verifications, and immediate reference ability, which when performed collectively, decrease the overall patient task requirement – not just the written order.

Another finding not supported by our data was the consensus that physicians will feel restricted and limited by CPOE systems. The data do not prove this for the sampled population, but might also be a reflection of no experience with an active system. Regardless, the implications again suggest a lesser need to defend accusations that CPOE systems will limit physicians authority or ability to practice medicine in exchange for a more productive educational approach of what the system can do for them.

Additionally, to help physicians feel an "ease of use," alternative technologies might be employed to assist in adoption of CPOE systems, such as PDA or pen-based notebooks. Although our data did not show an overwhelming desire to use alternative entry methods, they did conclude indirectly that any methodology that can be proven to improve the physicians workflow would be beneficial. For this reason, alternative technologies must always be considered when implementing CPOE systems.

Central to discussing how physicians' workflow could be improved, not how it would be changed, is the need for recognition of different requirements between other professions. The design of "user roles" or functional modules could help round out acceptability by other professions who would also use the system. Although the study was not designed to determine relative differences between professions, the data does show these differences exist and can be significant – especially when addressing pharmacy needs.

Another issue was how physicians would prefer to be trained. The results supported the most common methodology used by other hospitals: one-on-one training and the use of training booths with assistants readily available to answer questions (Figure 28: CPOE Training Preferences by Profession). These are most frequently placed in meeting areas such as doctor dining rooms and physician lounges.

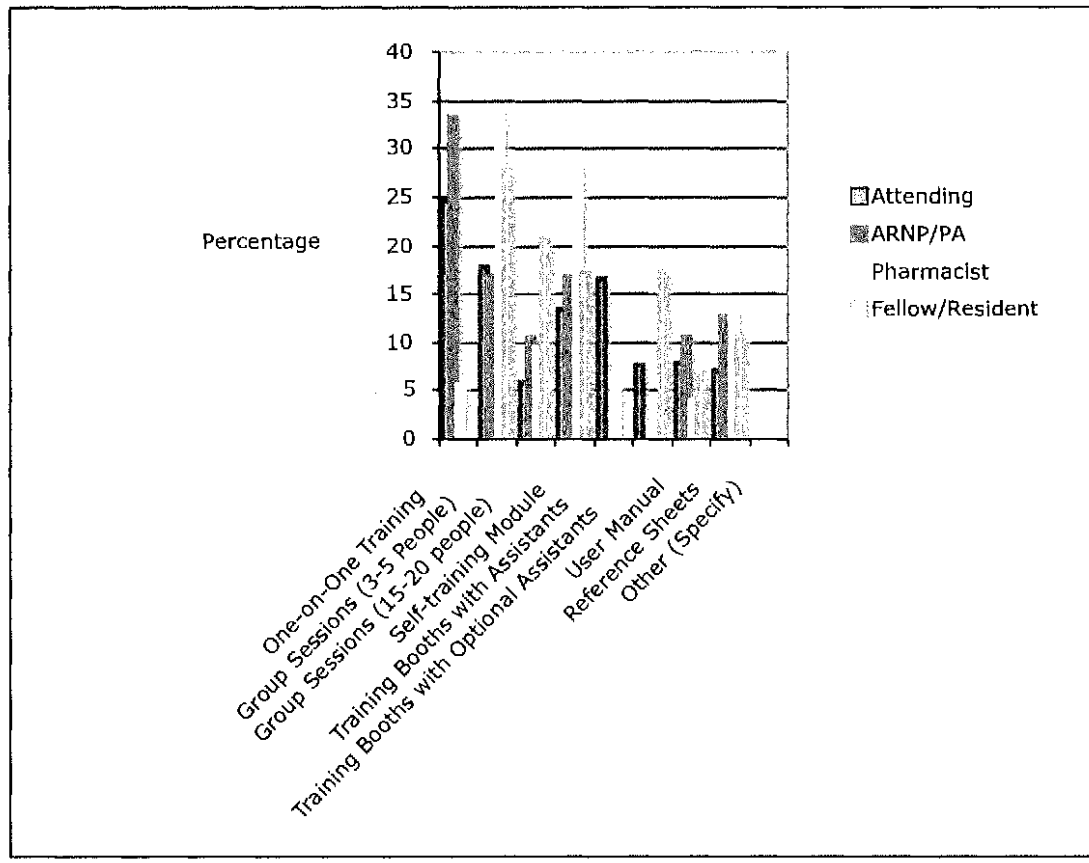

Figure 28: CPOE Training Preferences by Profession

Support was clearly an issue, with a majority of respondents desiring around-the-clock availability of immediate phone access for questions and issues as they arise. The significance of desiring this level of support relates back to the time and workflow issues. If the physicians cannot complete their required functions due to technical limitations or knowledge, they would consider this a major stumbling block to their acceptance. The availability of support must be mentioned at the forefront of any initiative and, ideally, even demonstrated to eliminate this potential hindrance to physician acceptance.

Questions that remain unanswered include the integration of physician training and their limited exposure to different practice environments as part of their educational process. Traditionally, most residents rotate through different units on a four week basis. These rotations leave little time to become accustomed to the individual unit systems with specific ordering requirements and nuisances. Our survey comments reflected these concerns by one of the participants stating, "resident training may be an issue for programs that have high resident rotation turnover" (Table 4: Participant Comments, Part I).

Yet the potential for learning also remains. Presumably through a developed set of guidelines that have been determined to be best-practice, evidenced-based management protocols, young physicians could gain insight into correct management much sooner without having to decipher individual variances and preferences. An opposing view would conclude the young physicians do not learn basic management protocols since the computer provides them with this information, thus limiting their learning experience.

Several authors have hoped for changes and even suggested the need for traditional training of physicians to reflect the integration of technology and the practice needs of future physicians [Hammond87, McGlade01, and Geiger03]. Simulations, development of best-practice protocols, computer interaction, and research are all essential skills for the physicians of tomorrow.

Finally, the potential for further study presents itself in a unique opportunity of returning to the same population, and repeating the survey six months to one year after implementation of the CPOE system has been completed. Insight into how physicians' attitudes have changed and other aspects of CPOE usage training and support would provide for a most interesting follow up study.

Chapter 8

CONCLUSION

While there is a preponderance of evidence demonstrating the effectiveness of CPOE systems in preventing medication errors and the subsequent mortality and morbidity that result from these errors each year, the literature still suggests overwhelming physician reluctance to adopt these systems despite their proven benefits. There is also historical evidence that failure to gain physician acceptance can result in devastating losses for an institution trying to implement such a system, both financially and politically.

This study was founded on the premise that physician acceptance was critical to a successful implementation. What was not known was how physicians' attitudes affected their acceptance or non-acceptance of such a system prior to its implementation. The question to be answered was what physicians' pre-conceived notions were with respect to CPOE systems, with the understanding that a successful implementation program could incorporate this knowledge to provide a more tailored approach to physician education and training.

A review of the history behind CPOE and the economic, institutional, individual, and societal reasons for implementing such a system were discussed. Additionally, the

examination of past and current attempts – both successful and unsuccessful was explored. With this knowledge, the study then focused on a group of physicians from a local major health care system located prior to the implementation of a CPOE system.

Physicians were surveyed in the hopes of ascertaining their opinions and attitudes. The resultant data set was able to support many assumptions used for implementations at other facilities, such as the use of physician-champions, the need for immediate access to support, and the need for ease of use. Further examination of the ease of use requirement revealed a multi-factorial etiology that involved fear of workflow changes and time requirements.

Underplayed in our sample was the need for education of the benefits and worth of CPOE systems. Our physician group was considerably more knowledgeable about the benefits and need for CPOE and further stated a high level of willingness to use such systems. They also expressed a very strong desire to be involved with system development and training. Suggestions that most physicians were reluctant to use CPOE systems because they felt they would have restrictions placed on their ability to practice medicine were also not evident with our surveyed group.

Based on our findings, recommendations were made to continue some of the current practices, while modification and/or less emphasis was probably warranted for others. This study should help those institutions readying themselves to begin a CPOE system

implementation by providing knowledge and insight into the mindsets of physicians' toward CPOE. This insight should help provide a more tailored approach to physician training and education, facilitating more physician acceptance and an eventual successful implementation of CPOE systems.

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APPENDIX A

Original Survey

Physician/Provider Survey
Computerized Physician Order Entry (CPOE)

Note: This survey is distributed as part of a graduate project sponsored in part, by the University of North Florida (UNF) Department of Computer Science. This survey, in its entirety, should not be construed to represent Baptist Health System and/or its affiliated institutions in any form or manner. The content and results of this survey are not intended to replace, supplement, or impact current plans for CPOE at any Baptist Health System site. All responses will remain strictly confidential.

Role (Select One) Experience (Years)

- ❑ Attending _____
- ❑ Fellow _____
- ❑ Resident _____
- ❑ ARNP/PA _____
- ❑ Pharmacist _____

Hospitalist? ❑ Yes ❑ No

Specialty _____

❑ Peds ❑ Adults

Average In-patients/week _____

❑ ICU ❑ Floor

Regarding CPOE: (Check One)	Disagree Strongly	Disagree Moderately	Neutral	Agree Moderately	Agree Strongly	N/A
In general, I feel CPOE is beneficial						
In general, I feel CPOE is inevitable						
In general, I feel CPOE will decrease my work						
In general, I feel CPOE will require less time						
In general, I feel CPOE will improve patient satisfaction						
CPOE will decrease ordering clarification calls						
CPOE will decrease order errors						
CPOE will improve patient outcomes						
CPOE will shorten length of stays						
CPOE will decrease provider liability						
CPOE will expand my ordering options						
CPOE will limit my autonomy						
CPOE is generally easy to use						
CPOE is a hindrance to patient care						
CPOE should always be optional						
If available, I would definitely use CPOE						
If asked, I would participate in CPOE development						
If asked, I would participate in CPOE training						
Core Providers should be involved in CPOE design						

(Please complete Side-B)

Regarding CPOE Usage: Which of the following would you desire/request:

(Select top 3-5 and rank by preference, 1 = most desired, 5 = least desired)

____ Handheld access	____ Off-site access	____ Availability/location of entry stations
____ Ease of use	____ Quick/immediate online access	____ Questions & Help "Hot-line" availability
____ Ease of training	____ On-screen reference prompts	____ On-screen alternative treatments prompts
____ Ability to quickly enter orders	____ Quick answer "cheat" sheets	____ System reliability (network, hardware)

Regarding CPOE Training: Which of the following would you desire/request:

(Select top three and rank by preference, 1 = most desired, 3 = least desired)

____ One-on-one training	____ Self-training module	____ User manual
____ Group sessions (3-5 people)	____ Training booths with assistance	____ Reference sheets
____ Group sessions (15-20 people)	____ Training booths with optional assistance	____ Other_____

Regarding CPOE Support: Which of the following would you desire/request:

(Select top three and rank by preference, 1 = most desired, 3 = least desired)

____ Dedicated phone support 24-7	____ User manuals/texts	____ User simplified "help" sheets
____ Dedicated phone support (M-F)	____ Training updates	____ User instruction sheets
____ User wallet cards	____ Individual support at entry site	____ Other _____

Comments:

_____

_____

_____

_____

_____

Thank-You!

Please return to: **John Hoffstatter, Suite 208, Howard Building, 820 Prudential Drive, Jacksonville, FL 32207 (904) 202-8794** john.hoffstatter@bmcjax.com.

APPENDIX B

Raw Data

Survey	Role	Experience	Hospitalist	Specialty	Peds/Adult	Avg In-Pts	ICU/Floor
1	Attending	<1	No	Surgery	Peds	4	Floor
2	Attending	17	Yes	Peds-GI	Peds	Blank	Blank
3	Attending	12	No	Blank	Blank	0	Blank
4	Attending	20	Blank	Neonatology	Peds	30-35	ICU
5	Attending	Blank	No	Infectious Diseases	Peds	15-20	Both
6	Attending	2	No	Blank	Peds	0	Blank
7	Attending	18	No	Peds	Peds	1	Floor
8	Attending	Blank	Blank	Blank	Blank	Blank	Blank
9	Attending	>23	No	GI	Peds	7	Floor
10	Pharmacist	3	Blank	Critical Care	Peds	Blank	Blank
11	Pharmacist	14	Blank	Blank	Adults	Blank	Blank
12	Pharmacist	1	Blank	Blank	Peds	Blank	Blank
13	Pharmacist	17	No	Blank	Blank	N/A	Blank
14	Pharmacist	7	Yes	Neonatology	Peds	Blank	Blank
15	Pharmacist	2	Blank	Blank	Blank	Blank	Blank
16	Pharmacist	23	Blank	Blank	Blank	Blank	Blank
17	Pharmacist	>20	Blank	Blank	Blank	Blank	Blank
18	Pharmacist	3	No	Blank	Peds	Blank	Blank
19	PA	6	Blank	PICU	Peds	Blank	ICU
20	ARNP/PA	10	Blank	PICU	Peds	Blank	ICU
21	ARNP/PA	17	Blank	PICU	Peds	15	ICU

Survey	Role	Experience	Hospitalist	Specialty	Peds/Adult	Avg In-Pts	ICU/Floor
22	Attending	30	No	Neo	Peds	Blank	ICU
23	Attending	1	Yes	Blank	Adults	21	Both
24	Attending	7	No	Blank	Peds	5	Floor
25	ARNP/PA	17	Blank	Peds Surg	Peds	20	Blank
26	ARNP/PA	18	Yes	Neonatology	Peds	40	ICU
27	Attending	39	No	Cardiology	Peds	0	Blank
28	PA	19+	Yes	Neo	Peds	42	ICU
29	Attending	8	No	Otolaryngology	Peds	Blank	Blank
30	Attending	15	No	ENT	Peds	1	Floor
31	Attending	11	No	Blank	Peds	2	Blank
32	Attending	18	No	FP	Blank	Blank	Floor
33	Attending	24	No	Blank	Peds	<1	Blank
34	Attending	20	No	Blank	Peds	5	Blank
35	Attending	13	No	Gen Surg	Adults	10	Blank
36	Attending	20	No	Critical Care	Adults	Blank	Blank
37	Attending	Blank	No	CD	Adults	Var'd	Blank
38	Attending	4	Yes	FM	Adults	30	Both
39	Attending	12	No	FP	Blank	Blank	Blank
40	Attending	25	Yes	Blank	Peds	10	Floor
41	Attending	14	Yes	Internal Medicine	Adults	120	Both
42	Attending	Blank	No	Gyn	Adults	2-3	Floor
43	Attending	10	Yes	FP	Adults	40	Both

Survey	Role	Experience	Hospitalist	Specialty	Peds/Adult	Avg In-Pts	ICU/Floor
44	Attending	12	No	Emergency Medicine	Both	30	Blank
45	Attending	20	Yes	Neo	Peds	Blank	ICU
46	ARNP/PA	~20	Blank	Blank	Blank	20	ICU
47	Attending	16	Yes	Critical Care	Peds	30	ICU
48	Attending	12	No	Blank	Blank	0	Blank
49	Attending	23	No	Blank	Peds	Blank	Blank
50	Fellow	Blank	No	ID	Peds	20	Both
51	Resident	<1	Blank	Nlank	Peds	Blank	Floor
52	Attending	21	No	Surgery	Blank	8	Floor
53	PA	19	Yes	Neo	Peds	8-9/day	ICU
54	Attending	24	No	Peds Ortho	Peds	3	Floor
55	Resident	3	Blank	Nlank	Peds	Blank	Blank
56	Attending	3	Yes	IM	Blank	40	Blank
57	Attending	1	No	Ortho	Peds	3	Floor
58	Attending	27	No	Blank	Peds	0-1	Floor
59	Attending	30	Yes	Peds	Peds	50	Floor
60	Attending	5	Blank	Blank	Peds	1	Floor
61	Attending	15	No	PHO	Peds	12	Floor
62	Attending	19	Blank	Pulmonology	Peds	10/day	Both
63	Resident	1	No	Blank	Blank	Blank	Floor
64	Attending	20	No	Peds GI	Peds	0	Blank
65	Attending	22	Blank	Neonatology	Blank	15	ICU
66	Resident	Months	Blank	Blank	Peds	Blank	Blank
67	Attending	2	Yes	Blank	Peds	50	Floor
68	Attending	19	Blank	Blank	Blank	4	Floor
69	Attending	Blank	Blank	Blank	Peds	Blank	Floor
70	Attending	10	No	General	Peds	3	*(Floor)
71	Attending	11	No	Pediatrics	Peds	1	Floor

Survey	A	B	C	D	E	F	G	H	I	J
1	5.0	5	4.5	3	3	Blank	4	2	2	4
2	5.0	5	2.0	3	3	4	4	4	2	4
3	4.5	5	3.0	3	4	4	4	4	3	4
4	2.0	2	2.0	2	2	2	1	2	2	2
5	5.0	5	4.0	4	4	5	5	5	3	4
6	5.0	4	4.0	4	3	4	4	4	3	3
7	4.0	5	2.0	2	3	4	4	4	2	4
8	3.0	3	3.0	4	3	4	4	3	2	2
9	4.0	5	2.0	1	3	2	4	3	1	3
10	4.0	4	2.0	3	4	2	3	4	2	4
11	5.0	Blank	5.0	1	5	4	5	5	0	1
12	4.0	5	2.0	1	3	4	2	4	2	2
13	5.0	4	3.0	3	4	4	4	4	3	3
14	4.0	5	1.0	2	3	2	4	2	1	1
15	Blank	Blank	2.0	2	3	1	2	3	3	1
16	4.0	5	2.0	2	4	4	4	4	4	2
17	2.0	4	1.0	1	2	2	2	2	1	1
18	4.0	Blank	3.0	4	3	1	2	3	2	1
19	4.0	5	3.0	3	5	5	5	5	5	5
20	4.0	4	3.0	3	4	4	4	4	3	4
21	3.0	4	2.0	2	3	4	4	3	2	3

Survey	A	B	C	D	E	F	G	H	I	J
22	0	4.0	3	3	3	4.0	5	3.0	3	3
23	5	5.0	4	4	3	5.0	5	5.0	3	3
24	4	3.5	3	3	3	3.5	3	3.5	2	2
25	3	5.0	3	3	3	3.0	3	3.0	3	3
26	5	5.0	4	4	4	3.0	3	3.0	3	3
27	5	5.0	4	4	3	5.0	5	5.0	3	5
28	5	5.0	2	2	3	4.5	5	4.0	4	4
29	3	5.0	2	2	3	4.0	3	3.0	1	3
30	5	5.0	2	2	4	5.0	5	5.0	3	4
31	3	4.0	3	3	2	4.0	5	3.0	2	2
32	4	5.0	4	4	4	5.0	5	4.0	3	4
33	4	5.0	2	2	3	5.0	5	5.0	3	4
34	3	4.0	3	3	4	4.0	2	3.0	2	2
35	5	5.0	*4	*4	3	5.0	5	4.0	4	3
36	5	5.0	3	3	4	5.0	5	5.0	4	4
37	4	5.0	4	4	5	5.0	5	4.0	3	4
38	3	4.0	1	1	3	4.0	4	4.0	3	4
39	5	5.0	4	4	4	5.0	5	4.0	3	4
40	3	4.0	5	2	2	4.0	4	3.0	2	3
41	5	5.0	3	3	5	5.0	5	5.0	5	4
42	5	5.0	5	5	3	5.0	5	4.0	3	5
43	5	5.0	3	3	5	5.0	5	5.0	5	4

Survey	A	B	C	D	E	F	G	H	I	J
44	5	5	3	3	4.0	5	4	4	4.0	3.0
45	*0	4	1	1	1.0	3	3	1	1.0	2.0
46	3	5	3	3	4.0	4	4	4	2.0	4.0
47	4	5	4	3	3.0	5	4	3	2.0	3.0
48	4	5	3	3	3.0	5	5	4	3.0	4.0
49	5	5	0	5	5.0	5	5	3	3.0	4.0
50	5	4	5	5	4.0	5	5	4	3.0	5.0
51	5	4	4	4	3.0	5	4	3	2.0	1.0
52	5	5	3	4	5.0	5	5	4	3.0	5.0
53	5	5	3	2	3.0	5	5	4	3.0	5.0
54	4	5	4	3	4.0	5	4	4	3.0	4.0
55	4	5	3	3	3.0	4	4	3	3.0	3.0
56	4	5	3	3	2.0	3	4	2	2.0	2.0
57	5	5	Blank	3	3.0	3	4	3	3.0	3.0
58	4	5	3	3	4.0	5	5	4	2.0	4.0
59	5	5	3	3	2.5	5	5	4	2.5	4.5
60	5	5	5	5	5.0	5	5	5	4.0	5.0
61	5	5	4	3	4.0	5	5	5	3.0	5.0
62	5	5	5	5	3.0	5	5	4	4.0	5.0
63	5	3	5	4	4.0	4	4	4	4.0	5.0
64	5	5	4	4	3.0	5	5	5	5.0	4.0
65	4	4	2	2	3.0	4	4	4	3.0	4.0
66	5	5	5	5	3.0	5	5	3	3.0	3.0
67	5	4	4	4	4.0	5	5	5	3.0	4.0
68	3	2	1	2	1.0	2	2	1	1.0	1.0
69	4	5	2	2	3.0	5	4	3	2.0	3.0
70	4	4	4	4	3.0	4	4	3	3.0	4.0
71	3	4	3	4	3.0	4	4	3	2.0	3.0

Survey	K	L	M	N	O	P	Q	R	S
1	3	2	4	2.0	1.0	5.0	Blank	5	5.0
2	3	4	3	2.0	2.0	4.0	3	4	5.0
3	3	2	3	3.5	2.5	3.5	2	4	4.5
4	2	2	2	2.0	3.0	1.0	2	4	5.0
5	4	2	4	2.0	2.0	4.0	3	3	4.0
6	3	2	4	2.0	3.0	4.0	3	4	4.0
7	2	3	3	2.0	2.0	4.0	4	4	4.0
8	2	3	4	3.0	4.0	3.0	3	3	3.0
9	2	2	1	2.0	1.0	4.0	4	4	5.0
10	4	2	3	1.0	2.0	4.0	4	4	4.0
11	1	1	5	1.0	1.0	0.0	5	5	5.0
12	2	4	2	3.0	2.0	3.0	4	4	5.0
13	*2	2	5	2.0	2.0	4.0	5	4	5.0
14	1	3	0	2.0	3.0	0.0	5	5	5.0
15	3	2	3	2.0	2.0	0.0	4	4	5.0
16	2	4	3	2.0	2.0	4.0	4	4	5.0
17	3	4	2	4.0	5.0	1.0	3	3	5.0
18	0	0	3	3.0	3.0	0.0	5	5	5.0
19	3	3	3	2.0	5.0	4.0	4	5	5.0
20	4	2	0	Blank	2.0	4.0	Blank	4	4.0
21	2	3	3	2.0	3.0	3.0	3	3	3.0

Survey	K	L	M	N	O	P	Q	R	S
22	3.0	0	2	3	4	3	2	2	3.0
23	2.0	2	5	1	5	5	4	5	5.0
24	2.5	3	3	3	3	4	4	3	3.5
25	3.0	3	3	3	3	3	3	3	1.0
26	3.0	3	4	2	2	4	4	4	4.0
27	4.0	1	4	2	1	5	3	3	5.0
28	1.0	4	2	1	3	4	5	5	5.0
29	3.0	3	3	3	3	3	4	4	5.0
30	4.0	2	3	3	2	4	3	4	5.0
31	3.0	3	3	3	5	3	3	3	4.0
32	3.0	2	3	2	1	5	5	5	5.0
33	3.0	3	2	2	4	2	1	5	5.0
34	2.0	3	3	3	2	3	2	2	4.0
35	4.0	2	**2	3	5	5	5	4	***5
36	5.0	2	4	1	1	5	5	5	5.0
37	3.0	2	3	1	3	5	5	4	4.0
38	2.0	4	1	4	3	3	4	4	4.0
39	4.0	2	4	2	2	4	5	5	5.0
40	2.0	3	2	4	3	3	3	3	5.0
41	2.0	1	4	1	1	5	5	5	5.0
42	3.0	2	5	1	1	5	4	4	5.0
43	3.0	2	5	1	1	5	5	5	5.0

Survey	K	L	M	N	O	P	Q	R	S
44	4	2	3	2	1	5	5.0	5	5
45	2	5	**0	Blank	5	**0	1.0	1	***3
46	3	3	0	2	3	4	4.0	4	4
47	4	2	4	3	3	4	3.0	4	5
48	3	3	2	3	2	3	3.0	4	5
49	0	0	0	2	3	0	0.0	0	4
50	4	2	5	1	1	5	3.0	3	4
51	4	2	4	1	1	5	4.0	5	4
52	3	3	0	1	1	5	5.0	5	5
53	1	4	2	1	2	5	5.0	5	5
54	3	2	3	2	3	4	4.0	5	5
55	4	3	4	3	4	4	3.0	4	4
56	1	4	3	4	4	3	4.0	4	5
57	3	2	3	2	2	4	4.0	3	5
58	3	3	*0	2	2	4	2.0	2	5
59	4	1	5	1	2	5	4.5	1	5
60	5	3	5	1	2	5	3.0	3	5
61	3	2	4	2	1	5	5.0	5	5
62	5	1	3	1	1	5	5.0	4	4
63	4	1	4	1	3	5	3.0	4	5
64	3	3	4	3	1	5	5.0	3	5
65	3	2	3	2	2	4	4.0	4	5
66	3	3	4	1	1	5	5.0	5	5
67	2	2	4	2	4	5	5.0	5	5
68	1	3	1	3	4	3	3.0	3	4
69	3	3	2	3	4	3	2.0	3	3
70	3	2	4	2	1	5	3.0	4	4
71	3	3	2	3	5	3	Blank	4	3

Survey	T	U	V
1	d, f, j, l, b	f, c, h	a, g, h
2	b, e, f, g, l	a, b, e	a, b, e
3	c, e, h, d, j	a, e, g	a, c, g
4	*(a-b-c-d-I-j-l, h-k, -, -, e-f)	**(b-e, a-c-f, d-g-h)	a, f, h
5	k, b, c, j, a	b, g, e	a, e, g
6	b, d, k, I, g	c, g, e	c, a, e
7	*(b, d, e, -, -)	f, b, d	f, a, h
8	Blank	Blank	Blank
9	*(b, d, l, c, a)	**(a, b, -)	***(c, -, -)
10	*(b, l, e, -, -)	d, h, b	d, a, g
11	a, l, d, b, f	c, b, d	a, c, d
12	j, g, a, k, h	*(d, e, h)	a, c, g
13	l, f, l, c, g	b, g, h	a, e, g
14	l, b, d, a, g	a, b, h	a, d, g
15	l, l, b, d, g	b, d, h	a, e, c
16	I, l, b, d, k	b, d, h	a, g, e
17	l, f, b, d, a	d, b, e	a, f, g
18	b, d, j, f, l	b, c, d	f, a, e
19	b, d, l, k, h	*(b, c, a, e, f)	**(a, b, c, c, f)
20	*(b-f, d, c, a)	c, h, d	g, e, b
21	b, c, d, a, l	b, d, g	c, a, h

Survey	T	U	V
22	*(a-b-c-d-e-f-j, g-h-I-k-l)	**(a-b-e, d-f-g, c-h)	***(a-f, b-g-h, c-d-e)
23	*(l, a-b, d, f-I-j, c)	**(a, e, -)	***(a, -, -)
24	*(b, c, f, -, -)	a, f, d	a, f, c
25	*(b-f-l, -, -, -, -)	a, b, d	a, e, h
26	*(b, c, d, l, -)	a, g, h	a, d, e
27	b, f, d, I, l	a, e, f	a, g, c
28	b, c, d, f, h	a, h, d	f, a, g
29	l, d, b, c, j	b, e, d	a, e, c
30	*(e, b, g, k, h)	**(e, g, -)	a, g, e
31	b, c, d, e, a	a, b, c	a, b, c
32	*(b, d, I, e, k, a)	a, b, e	a, b, c
33	c, b, d, h, j	c, h, a	c, g, a
34	*(b, f, l, -, -)	a, b, d	f, c, g
35	Blank	Blank	Blank
36	b, d, f, k, j	a, d, f	f, a, g
37	*(a-b-c-d-e-f-I-l, g-h-j-k, -, -, -)	**(d-g, a-c-e-h, b-f)	***(a, d-e-f-g-h, c)
38	*(f, d, a, -, -)	a, b, d	a, c, g
39	b, a, d, h, c	f, e, c	c, d, a
40	b, c, e, f, I	a, d, g	a, f, h
41	*(b-c-d-f-g-l, h-j-k, e, -, a-j)	**(a-d-h, -, b-c, -, e-f)	***(a-d, e, c-f-g-h, -, b)
42	b, e, a, d, f	a, d, b	a, c, g
43	*(a, l, d, -, -)	**(g, h, -)	***(a, e, -)

Survey	T	U	V
44	*(l, b, a, -, -)	b, a, e	a, e, c
45	****(b, a, c, -, -)	*****(a, b, -)	a, f, e
46	l, b, d, f, I	a, g, h	*(g, h, -)
47	*(a, b-c, g, f,e)	**(b, d, e, g, f)	***(a, f, c, d, g)
48	*(b-c-e-h, l, -, -, -)	**(a-h, -, -)	***(a-c-g)
49	Blank	Blank	Blank
50	*(a, f, e, -, -)	**(d, b, -)	**(a, d, -)
51	l, b, I, d, f	f, d, c	a, e, f
52	I, l, f, b, e	d, e, b	a, d, e
53	b, a, d, f, g	a, d, h	g, c, a
54	h, I, j, l, b	d, e, h	g, a, e
55	b, I, d, a, j	b, c, h	a, c, c
56	f, I, l, b, a	a, b, d	*(a, -, -)
57	e, f, k, d, j	a, d, b	a, b, e
58	l, a, b, I, d	a, g, d	**(a, f-g, -)
59	Blank	Blank	Blank
60	d, e, I, b, h	e, b, g	a, c, g
61	b, c, I, l, k	b, e, h	f, a, e
62	l, l, a, f, c	e, d, b	a, d, e
63	*(b, d, I, -, -)	c, f, h	f, a, d
64	*(b-c-d-e-g-h-j-k, -, a-I-l, f, -)	**(a-b-d-e-f-h, -, c-g)	***(a-c-g, -, b-d-e-f-h)
65	b, c, f, g, l	d, e, a	a, g, e
66	b, c,d, f, l	b, g, h	d, b, g
67	b, c, d, I, a	b, a, c	a, b, c
68	*(b-c-e-f-g-h-j-l, -, d-I, -, a-k)	**(a-b-e-g, -, c-d-f-h)	***(a-f-g, c-d-e-h, b)
69	Blank	Blank	Blank
70	e, f, b, g, c	d, g, f	c, d, e
71	*(a, b, e, -, -)	a, b, e	a, b, d

Survey	W
1	None
2	None
3	None
4	*('a-b-c-d-I-j-l' all entered as '1' and added 'Beside computer' also as '1', 'h-k' entered as '2', no '3' or '4' entered, 'e-f-g' all entered as '5', noted 'Need a clerk to enter'), **('b-e' both entered as '1', 'a-c-f' entered as '2', 'd-g-h' entered as '3')
5	None
6	None
7	*(Only 3 selections entered)
8	None
9	*(Selection 'j' with comment 'If this is needed the system is a failure'), **(Only 2 selections), ***(Only 1 selection), Comment: "As we evolve toward a technology dependent system we must put in place safeguards. This must be a 'zero-defect', '100% error free' system like airplanes!!!"
10	*(Only 3 selected)
11	None
12	*(For selection 'c' comment: 'No!! People do not train in large groups - look at orientation')
13	*('(PharmD)' added next to question), Comment: 'This new technology seems less than perfected, but at least some variation of it will be a standard in just a few years. I'm excited about the potential for standardization, therapeutic pathway development and the overall potential to improve patient care and decrease variation in care.'
14	Comment: 'System reliability & support will be key issues - No system is helpful if it is unavailable due to network or hardware failures. Also special populations' needs must be addressed (ie pediatrics and especially neonates - where very specific doses are required & frequently dosage forms are not available)'
15	None
16	None
17	Comment: 'To me, a step backward, relegating professionals to secretarial functions'
18	None
19	*(5 selections made), **(5 selections made)
20	*(Both 'b' and 'f' were entered as '1' with no '5' entered)
21	None

Survey	W
22	*('a-b-c-d-e-f-j' all entered as '1', 'g-h-I-k-l' all entered as '2', no '3', '4' or '5' entered), **('a-b-e' entered as '1', 'd-f-g' entered as '2', and 'c-h' entered as '3'), ***('a-f' entered as '1', 'b-g-h' entered as '2', 'c-d-e' entered as '3')
23	*('a-b' both entered as '2', 'f-I-j-k' entered as '4'), **(Only 2 selected), ***(Only 1 selected)
24	*(Only 3 selected)
25	*('b-f-l' all selected as '1' and no other selections made for '2-5')
26	*(Only '1-4' selections made)
27	None
28	None
29	None
30	*(Added comment: 'All Appropriate!'), **(Only 2 selections made), Comment: 'have enough stations available for peak use time'
31	None
32	*(6 selections made)
33	Comment: 'Personally, I am a computer illiterate & will be part of the group needing tutoring. <smile face>'
34	*(Only 3 selected)
35	*('Not Initially added next to questions), **(Not Intuitive At All' added next to question), ***(Selection '5' was checked 6 times over), Side II was not completed
36	None
37	*('a-b-c-d-e-f-l-l' all selected as 'a'. 'g-h-j-k' selected as '2', no selections for '3-5' made), **('d-g' selected as '1'. 'a-c-e-h' selected as '2', 'b-f' selected as '3'), ***('d-e-f-g-h' all selected as '2')
38	*(Only 3 selections made)
39	Comment: 'Very Promising & Exciting System!'
40	None
41	*('b-c-d-f-g-l' entered as '1', 'h-j' entered as '2', no '4' entered, 'a-j' entered as '5'), **('a-d-g-h' entered as '1', no 2' entered, 'b-c' entered as '3', and 'e-f' entered as '5' with no '4' entered), ***('a-d' entered as '1', 'c-g-h' entered as '3', and 'b' entered as '5' with no '4' entered)
42	None
43	*(Only 3 selected), **(Only 2 selected), ***(Only 2 selected)

Survey	W
44	*(Only 3 selected)
45	*('How would I know?' added to response), **('Don't know' added to response), ***('What are core providers' added to question), ****(Only 3 selected), *****(Only 2 selected)
46	*(Only 2 selected)
47	*('b-c' both entered for '2'), **(5 selections made), ***(5 selections made)
48	*('b-c-e-h' all selected as '1', no selections made for '3-5'), **('a-h' both entered for '1', no '2-3' selections made), ***('a-c-g' all entered as '1', no selections made for '2-3'), Comment: 'I'm afraid of computers!'
49	Page 2 not completed
50	*(Only 3 selected), **(Only 2 selected)
51	None
52	None
53	None
54	Comment: 'Resident training may be an issue for programs that have high resident rotation turnover'
55	None
56	*(Only 1 selected)
57	None
58	*('Don't know' placed above 'N/A' heading), **(No third selection made)
59	Page 2 not completed
60	None
61	None
62	None
63	*('f-j' circled without a '4' or '5' assigned to either - left blank)
64	*('b-c-d-e-g-h-j-k' entered as '1', no '2' entered, 'a-l-l' entered as '3', no '5' entered), **('q-b-d-e-f-h' entered as '1', no '2' entered, 'c-g' entered as '3'), ***('a-c-g' entered as '1', no '2' entered, 'b-d-e-f-h' entered as '3')
65	None
66	None
67	None
68	*('b-c-e-f-g-h-j-l' entered as '1', no '2' entered, 'd-l' entered as '3', no '4' entered, 'a-k' entered as '5'), **('a-b-e-g' entered as '1', no '2' entered, 'c-d-f-h' entered as '3'), ***('a-f-g' entered as '1', 'c-e-h' entered as '2')
69	Page 2 not completed
70	*('Nursery' added next to selection)
71	*(Only 3 selected)

APPENDIX C

Adjusted Data

Survey	Role	Experience	Hospitalist	Specialty	Peds/Adult
1	Attending	<1	No	Surgery - Pediatric	Peds
2	Attending	17	Yes	Gastroenterology - Pediatric	Peds
3	Attending	12	No	Blank	Blank
4	Attending	20	Yes	Neonatology	Peds
5	Attending	Blank	No	Infectious Diseases - Pediatric	Peds
6	Attending	2	No	Pediatrics - General	Peds
7	Attending	18	No	Pediatrics - General	Peds
8	Attending	Blank	Blank	Blank	Blank
9	Attending	>23	No	Gastroenterology - Pediatric	Peds
10	Pharmacist	3	Yes	Critical Care - Pediatric	Peds
11	Pharmacist	14	Blank	Blank	Adults
12	Pharmacist	1	Blank	Pediatrics - General	Peds
13	Pharmacist	17	No	Blank	Blank
14	Pharmacist	7	Yes	Neonatology	Peds
15	Pharmacist	2	Blank	Blank	Blank
16	Pharmacist	23	Blank	Blank	Blank
17	Pharmacist	>20	Blank	Blank	Blank
18	Pharmacist	3	No	Pediatrics - General	Peds
19	PA	6	Yes	Critical Care - Pediatric	Peds
20	PA	10	Yes	Critical Care - Pediatric	Peds
21	PA	17	Yes	Critical Care - Pediatric	Peds

Survey	Role	Experience	Hospitalist	Specialty	Peds/Adult
22	Attending	30	Yes	Neonatology	Peds
23	Attending	1	Yes	Blank	Adults
24	Attending	7	No	Pediatrics - General	Peds
25	PA	17	Blank	Surgery - Pediatric	Peds
26	PA	18	Yes	Neonatology	Peds
27	Attending	39	No	Cardiology - Pediatric	Peds
28	PA	19+	Yes	Neonatology	Peds
29	Attending	8	No	Otolaryngology - Pediatric	Peds
30	Attending	15	No	ENT - Pediatric	Peds
31	Attending	11	No	Pediatrics - General	Peds
32	Attending	18	No	Family Practice	Blank
33	Attending	24	No	Pediatrics - General	Peds
34	Attending	20	No	Pediatrics - General	Peds
35	Attending	13	No	General Surgery - Adult	Adults
36	Attending	20	Yes	Critical Care - Adult	Adults
37	Attending	Blank	No	Cardiac Disease	Adults
38	Attending	4	Yes	Family Practice	Adults
39	Attending	12	No	Family Practice	Blank
40	Attending	25	Yes	Pediatrics - General	Peds
41	Attending	14	Yes	Internal Medicine	Adults
42	Attending	Blank	No	Gynecology	Adults
43	Attending	10	Yes	Family Practice	Adults

Survey	Role	Experience	Hospitalist	Specialty	Peds/Adult
44	Attending	12	No	Emergency Medicine	Both
45	Attending	20	Yes	Neonatology	Peds
46	PA	20	Yes	Critical Care - Pediatric	Peds
47	Attending	16	Yes	Critical Care - Pediatric	Peds
48	Attending	12	No	Blank	Blank
49	Attending	23	No	Pediatrics - General	Peds
50	Fellow	Blank	No	Infectious Diseases - Pediatrics	Peds
51	Resident	<1	Blank	Pediatrics - General	Peds
52	Attending	21	No	Surgery	Blank
53	PA	19	Yes	Neonatology	Peds
54	Attending	24	No	Orthopedics - Pediatrics	Peds
55	Resident	3	Blank	Pediatrics - General	Peds
56	Attending	3	Yes	Internal Medicine	Adult
57	Attending	1	No	Pediatric Orthopedics	Peds
58	Attending	27	No	Pediatrics - General	Peds
59	Attending	30	Yes	Pediatrics - General	Peds
60	Attending	5	Blank	Pediatrics - General	Peds
61	Attending	15	No	Pediatrics - General	Peds
62	Attending	19	Blank	Pulmonology - Pediatric	Peds
63	Resident	1	No	Blank	Blank
64	Attending	20	No	Gastroenterology - Pediatric	Peds
65	Attending	22	Yes	Neonatology	Peds
66	Resident	Months	Blank	Pediatrics - General	Peds
67	Attending	2	Yes	Pediatrics - General	Peds
68	Attending	19	Blank	Blank	Blank
69	Attending	Blank	Blank	Pediatrics - General	Peds
70	Attending	10	No	Pediatrics - General	Peds
71	Attending	11	No	Pediatrics - General	Peds

Survey	Avg In-Pts	ICU/Floor	A	B	C	D	E	F	G	H
1	4	Floor	5	5	5	4	3	Blank	4	2
2	Blank	Blank	5	5	2	3	3	4	4	4
3	0	Blank	5	5	3	3	4	4	4	4
4	30-35	ICU	2	2	2	2	2	2	1	2
5	15-20	Both	5	5	4	4	4	5	5	5
6	0	Blank	5	4	4	4	3	4	4	4
7	1	Floor	4	5	2	2	3	4	4	4
8	Blank	Blank	3	3	3	4	3	4	4	3
9	7	Floor	4	5	2	1	3	2	4	3
10	Blank	Yes	4	4	2	3	4	2	3	4
11	Blank	Blank	5	Blank	5	1	5	4	5	5
12	Blank	Blank	4	5	2	1	3	4	2	4
13	N/A	Blank	5	4	3	3	4	4	4	4
14	Blank	ICU	4	5	1	2	3	2	4	2
15	Blank	Blank	Blank	Blank	2	2	3	1	2	3
16	Blank	Blank	4	5	2	2	4	4	4	4
17	Blank	Blank	2	4	1	1	2	2	2	2
18	Blank	Blank	4	Blank	3	4	3	1	2	3
19	Blank	ICU	4	5	3	3	5	5	5	5
20	Blank	ICU	4	4	3	3	4	4	4	4
21	15	ICU	3	4	2	2	3	4	4	3

Survey	Avg In-Pts	ICU/Floor	A	B	C	D	E	F	G	H
22	Blank	ICU	0	4	3	3	3	4	5	3
23	21	Both	5	5	4	4	3	5	5	5
24	5	Floor	4	4	3	3	3	4	3	4
25	20	Blank	3	5	3	3	3	3	3	3
26	40	ICU	5	5	4	4	4	3	3	3
27	0	Blank	5	5	4	4	3	5	5	5
28	42	ICU	5	5	2	2	3	5	5	4
29	Blank	Blank	3	5	2	2	3	4	3	3
30	1	Floor	5	5	2	2	4	5	5	5
31	2	Blank	3	4	3	3	2	4	5	3
32	Blank	Floor	4	5	4	4	4	5	5	4
33	<1	Blank	4	5	2	2	3	5	5	5
34	5	Blank	3	4	3	3	4	4	2	3
35	10	Blank	5	5	*4	*4	3	5	5	4
36	Blank	ICU	5	5	3	3	4	5	5	5
37	Var'd	Blank	4	5	4	4	5	5	5	4
38	30	Both	3	4	1	1	3	4	4	4
39	Blank	Blank	5	5	4	4	4	5	5	4
40	10	Floor	3	4	5	2	2	4	4	3
41	120	Both	5	5	3	3	5	5	5	5
42	3-Feb	Floor	5	5	5	5	3	5	5	4
43	40	Both	5	5	3	3	5	5	5	5

Survey	Avg In-Pts	ICU/Floor	A	B	C	D	E	F	G	H
44	30	Blank	5	5	3	3	4	5	4	4
45	Blank	ICU	*0	4	1	1	1	3	3	1
46	20	ICU	3	5	3	3	4	4	4	4
47	30	ICU	4	5	4	3	3	5	4	3
48	0	Blank	4	5	3	3	3	5	5	4
49	Blank	Blank	5	5	0	5	5	5	5	3
50	20	Both	5	4	5	5	4	5	5	4
51	Blank	Floor	5	4	4	4	3	5	4	3
52	8	Floor	5	5	3	4	5	5	5	4
53	8-9/day	ICU	5	5	3	2	3	5	5	4
54	3	Floor	4	5	4	3	4	5	4	4
55	Blank	Blank	4	5	3	3	3	4	4	3
56	40	Blank	4	5	3	3	2	3	4	2
57	3	Floor	5	5	Blank	3	3	3	4	3
58	0-1	Floor	4	5	3	3	4	5	5	4
59	50	Floor	5	5	3	3	3	5	5	4
60	1	Floor	5	5	5	5	5	5	5	5
61	12	Floor	5	5	4	3	4	5	5	5
62	10/day	Both	5	5	5	5	3	5	5	4
63	Blank	Floor	5	3	5	4	4	4	4	4
64	0	Blank	5	5	4	4	3	5	5	5
65	15	ICU	4	4	2	2	3	4	4	4
66	Blank	Blank	5	5	5	5	3	5	5	3
67	50	Floor	5	4	4	4	4	5	5	5
68	4	Floor	3	2	1	2	1	2	2	1
69	Blank	Floor	4	5	2	2	3	5	4	3
70	3	*(Floor)	4	4	4	4	3	4	4	3
71	1	Floor	3	4	3	4	3	4	4	3

Survey	I	J	K	L	M	N	O	P	Q	R	S
1	2	4	3	2	4	2	1	5	Blank	5	5
2	2	4	3	4	3	2	2	4	3	4	5
3	3	4	3	2	3	4	3	4	2	4	5
4	2	2	2	2	2	2	3	1	2	4	5
5	3	4	4	2	4	2	2	4	3	3	4
6	3	3	3	2	4	2	3	4	3	4	4
7	2	4	2	3	3	2	2	4	4	4	4
8	2	2	2	3	4	3	4	3	3	3	3
9	1	3	2	2	1	2	1	4	4	4	5
10	2	4	4	2	3	1	2	4	4	4	4
11	0	1	1	1	5	1	1	0	5	5	5
12	2	2	2	4	2	3	2	3	4	4	5
13	3	3	*2	2	5	2	2	4	5	4	5
14	1	1	1	3	0	2	3	0	5	5	5
15	3	1	3	2	3	2	2	0	4	4	5
16	4	2	2	4	3	2	2	4	4	4	5
17	1	1	3	4	2	4	5	1	3	3	5
18	2	1	0	0	3	3	3	0	5	5	5
19	5	5	3	3	3	2	5	4	4	5	5
20	3	4	4	2	0	Blank	2	4	Blank	4	4
21	2	3	2	3	3	2	3	3	3	3	3

Survey	I	J	K	L	M	N	O	P	Q	R	S
22	3	3	3	0	2	3	4	3	2	2	3
23	3	3	2	2	5	1	5	5	4	5	5
24	2	2	3	3	3	3	3	4	4	3	4
25	3	3	3	3	3	3	3	3	3	3	1
26	3	3	3	3	4	2	2	4	4	4	4
27	3	5	4	1	4	2	1	5	3	3	5
28	4	4	1	4	2	1	3	4	5	5	5
29	1	3	3	3	3	3	3	3	4	4	5
30	3	4	4	2	3	3	2	4	3	4	5
31	2	2	3	3	3	3	5	3	3	3	4
32	3	4	3	2	3	2	1	5	5	5	5
33	3	4	3	3	2	2	4	2	1	5	5
34	2	2	2	3	3	3	2	3	2	2	4
35	4	3	4	2	**2	3	5	5	5	4	***5
36	4	4	5	2	4	1	1	5	5	5	5
37	3	4	3	2	3	1	3	5	5	4	4
38	3	4	2	4	1	4	3	3	4	4	4
39	3	4	4	2	4	2	2	4	5	5	5
40	2	3	2	3	2	4	3	3	3	3	5
41	5	4	2	1	4	1	1	5	5	5	5
42	3	5	3	2	5	1	1	5	4	4	5
43	5	4	3	2	5	1	1	5	5	5	5

Survey	I	J	K	L	M	N	O	P	Q	R	S
44	4	3	4	2	3	2	1	5	5	5	5
45	1	2	2	5	**0	Blank	5	**0	1	1	***3
46	2	4	3	3	0	2	3	4	4	4	4
47	2	3	4	2	4	3	3	4	3	4	5
48	3	4	3	3	2	3	2	3	3	4	5
49	3	4	0	0	0	2	3	0	0	0	4
50	3	5	4	2	5	1	1	5	3	3	4
51	2	1	4	2	4	1	1	5	4	5	4
52	3	5	3	3	0	1	1	5	5	5	5
53	3	5	1	4	2	1	2	5	5	5	5
54	3	4	3	2	3	2	3	4	4	5	5
55	3	3	4	3	4	3	4	4	3	4	4
56	2	2	1	4	3	4	4	3	4	4	5
57	3	3	3	2	3	2	2	4	4	3	5
58	2	4	3	3	*0	2	2	4	2	2	5
59	3	5	4	1	5	1	2	5	5	1	5
60	4	5	5	3	5	1	2	5	3	3	5
61	3	5	3	2	4	2	1	5	5	5	5
62	4	5	5	1	3	1	1	5	5	4	4
63	4	5	4	1	4	1	3	5	3	4	5
64	5	4	3	3	4	3	1	5	5	3	5
65	3	4	3	2	3	2	2	4	4	4	5
66	3	3	3	3	4	1	1	5	5	5	5
67	3	4	2	2	4	2	4	5	5	5	5
68	1	1	1	3	1	3	4	3	3	3	4
69	2	3	3	3	2	3	4	3	2	3	3
70	3	4	3	2	4	2	1	5	3	4	4
71	2	3	3	3	2	3	5	3	Blank	4	3

Survey	T	U	V
1	d, f, j, l, b	f, c, h	a, g, h
2	b, e, f, g, l	a, b, e	a, b, e
3	c, e, h, d, j	a, e, g	a, c, g
4	*(a-b-c-d-l-j-l, h-k, -, -, e-f)	**(b-e, a-c-f, d-g-h)	a, f, h
5	k, b, c, j, a	b, g, c	a, e, g
6	b, d, k, l, g	c, g, c	c, a, e
7	*(b, d, e, -, -)	f, b, d	f, a, h
8	Blank	Blank	Blank
9	*(b, d, l, c, a)	**(a, b, -)	***(c, -, -)
10	*(b, l, e, -, -)	d, h, b	d, a, g
11	a, l, d, b, f	c, b, d	a, c, d
12	j, g, a, k, h	*(d, c, h)	a, c, g
13	l, f, l, e, g	b, g, h	a, e, g
14	l, b, d, a, g	a, b, h	a, d, g
15	l, l, b, d, g	b, d, h	a, e, c
16	l, l, b, d, k	b, d, h	a, g, e
17	l, f, b, d, a	d, b, e	a, f, g
18	b, d, j, f, l	b, c, d	f, a, e
19	b, d, l, k, h	*(b, c, a, e, f)	**(a, b, c, c, f)
20	*(b-f, d, c, a)	c, h, d	g, e, b
21	b, c, d, a, l	b, d, g	c, a, h

Survey	T	U	V
22	*(a-b-c-d-e-f-j, g-h-l-k-l)	**(a-b-e, d-f-g, c-h)	***(a-f, b-g-h, c-d-e)
23	*(l, a-b, d, f-l-j, c)	**(a, e, -)	***(a, -, -)
24	*(b, e, f, -, -)	a, f, d	a, f, c
25	*(b-f-l, -, -, -, -)	a, b, d	a, e, h
26	*(b, c, d, i, -)	a, g, h	a, d, e
27	b, f, d, l, l	a, e, f	a, g, c
28	b, c, d, f, h	a, h, d	f, a, g
29	l, d, b, c, j	b, e, d	a, e, c
30	*(e, b, g, k, h)	**(e, g, -)	a, g, e
31	b, c, d, e, a	a, b, c	a, b, c
32	*(b, d, l, e, k, a)	a, b, e	a, b, c
33	c, b, d, h, j	e, h, a	c, g, a
34	*(b, f, l, -, -)	a, b, d	f, c, g
35	Blank	Blank	Blank
36	b, d, f, k, j	a, d, f	f, a, g
37	*(a-b-c-d-e-f-l-l, g-h-j-k, -, -, -)	**(d-g, a-c-e-b, b-f)	***(a, d-e-f-g-h, c)
38	*(f, d, a, -, -)	a, b, d	a, c, g
39	b, a, d, h, e	f, e, c	c, d, a
40	b, c, e, f, l	a, d, g	a, f, h
41	*(b-c-d-f-g-l, h-j-k, e, -, a-j)	**(a-d-h, -, b-c, -, e-f)	***(a-d, e, c-f-g-h, -, b)
42	b, e, a, d, f	a, d, b	a, e, g
43	*(a, l, d, -, -)	**(g, h, -)	***(a, e, -)

Survey	T	U	V
44	*(l, b, a, -, -)	b, a, e	a, e, c
45	****(b, a, c, -, -)	*****(a, b, -)	a, f, e
46	l, b, d, f, l	a, g, h	*(g, h, -)
47	*(a, b-c, g, f,e)	**(b, d, e, g, f)	***(a, f, c, d, g)
48	*(b-c-e-h, l, -, -, -)	**(a-h, -, -)	***(a-c-g)
49	Blank	Blank	Blank
50	*(a, f, e, -, -)	**(d, b, -)	**(a, d, -)
51	l, b, l, d, f	f, d, c	a, e, f
52	l, l, f, b, e	d, e, b	a, d, e
53	b, a, d, f, g	a, d, h	g, c, a
54	h, l, j, l, b	d, e, h	g, a, e
55	b, l, d, a, j	b, c, h	a, c, c
56	f, l, l, b, a	a, b, d	*(a, -, -)
57	e, f, k, d, j	a, d, b	a, b, e
58	l, a, b, l, d	a, g, d	**(a, f-g, -)
59	Blank	Blank	Blank
60	d, e, l, b, h	e, h, g	a, c, g
61	b, c, l, l, k	b, e, h	f, a, e
62	l, l, a, f, e	e, d, b	a, d, e
63	*(b, d, l, -, -)	c, f, h	f, a, d
64	*(b-c-d-e-g-h-j-k, -, a-l-l, f, -)	**(a-b-d-e-f-h, -, c-g)	***(a-c-g, -, b-d-e-f-h)
65	b, c, f, g, l	d, e, a	a, g, e
66	b, c,d, f, l	b, g, h	d, h, g
67	b, c, d, l, a	b, a, c	a, b, c
68	*(b-c-e-f-g-h-j-l, -, d-l, -, a-k)	**(a-b-e-g, -, c-d-f-h)	***(a-f-g, c-d-e-h, b)
69	Blank	Blank	Blank
70	e, f, b, g, c	d, g, f	c, d, e
71	*(a, b, e, -, -)	a, b, c	a, b, d

Survey	W
1	None
2	None
3	None
4	*('a-b-c-d-I-j-l' all entered as '1' and added 'Beside computer' also as '1', 'h-k' entered as '2', no '3' or '4' entered, 'e-f-g' all entered as '5', noted 'Need a clerk to enter'), **('b-e' both entered as '1', 'a-c-f' entered as '2', 'd-g-h' entered as '3')
5	None
6	None
7	*(Only 3 selections entered)
8	None
9	*(Selection 'j' with comment 'If this is needed the system is a failure'), **(Only 2 selections), ***(Only 1 selection), Comment: "As we evolve toward a technology dependent system we must put in place safeguards. This must be a 'zero-defect', '100% error free' system like airplanes!!!"
10	*(Only 3 selected)
11	None
12	*(For selection 'c' comment: 'No!! People do not train in large groups - look at orientation')
13	*('(PharmD)' added next to question), Comment: 'This new technology seems less than perfected, but at least some variation of it will be a standard in just a few years. I'm excited about the potential for standardization, therapeutic pathway development and the overall potential to improve patient care and decrease variation in care.'
14	Comment: 'System reliability & support will be key issues - No system is helpful if it is unavailable due to network or hardware failures. Also special populations' needs must be addressed (ie pediatrics and especially neonates - where very specific doses are required & frequently dosage forms are not available)'
15	None
16	None
17	Comment: 'To me, a step backward, relegating professionals to secretarial functions'
18	None
19	*(5 selections made), **(5 selections made)
20	*(Both 'b' and 'f' were entered as '1' with no '5' entered)
21	None

Survey	W
22	*('a-b-c-d-e-f-j' all entered as '1', 'g-h-i-k-l' all entered as '2', no '3', '4' or '5' entered), **('a-b-e' entered as '1', 'd-f-g' entered as '2', and 'c-h' entered as '3'), ***('a-f' entered as '1', 'b-g-h' entered as '2', 'c-d-e' entered as '3')
23	*('a-b' both entered as '2', 'f-l-j-k' entered as '4'), **(Only 2 selected), ***(Only 1 selected)
24	*(Only 3 selected)
25	*('b-f-l' all selected as '1' and no other selections made for '2-5')
26	*(Only '1-4' selections made)
27	None
28	None
29	None
30	*(Added comment: 'All Appropriate!'), **(Only 2 selections made), Comment: 'have enough stations available for peak use time'
31	None
32	*(6 selections made)
33	Comment: 'Personally, I am a computer illiterate & will be part of the group needing tutoring. <smile face>'
34	*(Only 3 selected)
35	*('Not Initially added next to questions), **(Not Intuitive At All' added next to question), ***(Selection '5' was checked 6 times over), Side II was not completed
36	None
37	*('a-h-c-d-e-f-l-l' all selected as 'a'. 'g-h-j-k' selected as '2', no selections for '3-5' made), **('d-g' selected as '1'. 'a-c-e-h' selected as '2', 'b-f' selected as '3'), ***('d-e-f-g-h' all selected as '2')
38	*(Only 3 selections made)
39	Comment: 'Very Promising & Exciting System!'
40	None
41	*('b-c-d-f-g-l' entered as '1', 'h-j' entered as '2', no '4' entered, 'a-j' entered as '5'), **('a-d-g-h' entered as '1', no 2' entered, 'b-c' entered as '3', and 'e-f' entered as '5' with no '4' entered), ***('a-d' entered as '1', 'c-g-h' entered as '3', and 'b' entered as '5' with no '4' entered)
42	None
43	*(Only 3 selected), **(Only 2 selected), ***(Only 2 selected)

Survey	W
44	*(Only 3 selected)
45	*('How would I know?' added to response), **('Don't know' added to response), ***('What are core providers' added to question), ****(Only 3 selected), *****(Only 2 selected)
46	*(Only 2 selected)
47	*('b-c' both entered for '2'), **(5 selections made), ***(5 selections made)
48	*('b-c-e-h' all selected as '1', no selections made for '3-5'), **('a-h' both entered for '1', no '2-3' selections made), ***('a-c-g' all entered as '1', no selections made for '2-3'), Comment: 'I'm afraid of computers!'
49	Page 2 not completed
50	*(Only 3 selected), **(Only 2 selected)
51	None
52	None
53	None
54	Comment: 'Resident training may be an issue for programs that have high resident rotation turnover'
55	
56	*(Only 1 selected)
57	None
58	*('Don't know' placed above 'N/A' heading), **(No third selection made)
59	Page 2 not completed
60	None
61	None
62	None
63	*('f-j' circled without a '4' or '5' assigned to either - left blank)
64	*('b-c-d-e-g-h-j-k' entered as '1', no '2' entered, 'a-l-l' entered as '3', no '5' entered), **('q-b-d-e-f-h' entered as '1', no '2' entered, 'c-g' entered as '3'), ***('a-c-g' entered as '1', no '2' entered, 'b-d-e-f-h' entered as '3')
65	None
66	None
67	None
68	*('b-c-e-f-g-h-j-l' entered as '1', no '2' entered, 'd-l' entered as '3', no '4' entered, 'a-k' entered as '5'), **('a-b-e-g' entered as '1', no '2' entered, 'c-d-f-h' entered as '3'), ***('a-f-g' entered as '1', 'c-e-h' entered as '2')
69	Page 2 not completed
70	*('Nursery' added next to selection)
71	*(Only 3 selected)

VITA

John Arthur Hoffstatter has a Bachelor of Science from Alderson-Broaddus College in Medical Science and expects to receive a Master of Science in Computer and Information Sciences from the University of North Florida in Software Engineering, December 2004. Dr. Robert F. Roggio, Professor from University of North Florida is serving as John's thesis advisor.

John is currently employed as the Director of Physician Assistant and Advanced Nurse Practitioner Services (WCH PA/ARNP) for Wolfson Children's Hospital, Baptist Health System. Prior to his current position, John was employed in various professional positions to include Manager, Coordinator, and a Neonatal Physician Assistant in the Neonatal Intensive Care Unit at the hospital.

John has ongoing interests in the use of computerized systems and their application with in the health care system – particularly with applications and implementation of clinical physician applications. John's professional experience includes direct involvement with development, implementation and maintenance of various computerized physician documentation systems over the past ten years in addition to clinical and administrative responsibilities over nearly twenty years. Academically,

John has gained knowledge in Java, COBOL, C, UNIX, SQL, MySQL, Oracle, and DBA systems and their use and practical applications.

John remains active in his church and enjoys his marriage of over 22 years to his wife Martha, and his 17 year old daughter and 15 year old son.